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Industrial Safety

WITH the continuation well into 1937 of the previous year's renewed industrial activity, it was to be expected that the number of industrial accidents would show an increase. But although the annual report of the Chief Inspector of Factories for 1937, which has just been published, does record a substantial increase in the total number of accidents reported, on the whole the position revealed by the report is not unsatisfactory. Both the total number of accidents (fatal and non-fatal) and the number of fatal accidents increased by approximately 9 per cent. respectively compared with 1936; on the other hand this increase, in the case of the total number of accidents (the more significant figure), was about half the increase in 1936 over the previous year.

The new Act which came into force on July 1 should cause a considerable slowing-up of the annual rate of accident increase in proportion to industrial activity even if the actual aggregate number of accidents does not show an immediate fall. For it must certainly take some time before all the necessary and sometimes complicated requirements of the new Act are fully complied with by industry. It is interesting to see throughout the report references to the new Act as providing remedial measures for some of the factors at present operating as sources of danger to industrial safety. As in former years, the employment of unskilled or partly skilled workers has been responsible for a great number of accidents and, to take the other extreme, skilled workers, who may be conscious of the danger of a particular operation and think that they are too clever to be caught, have also caused accidents, particularly in connection with revolving shafting.

So far as the chemical industry is concerned (including artificial manure, coal tar, paint and varnish manufacture), there were 4,389 accidents in 1937 as compared with 3,958 in 1936. Of these 339 were due to machinery moved by mechanical power, 157 to transport, 16 to electricity, 50 to machinery not moved by mechanical power, 248 to stepping on or striking against objects, and 361 to the use of hand tools. Other miscellaneous causes common to all manufactures are listed, and excluding for the moment those such as explosions and gassing which are peculiar to the chemical industry, the most prolific sources of accident were

those due to being struck by a falling body (410), to persons falling (765), and to handling goods (1,063).

It can be seen from these figures what a potent factor carelessness is in accident causation, the large number of accidents under the headings of handling goods, stepping on or striking against objects, and the use of hand tools must have arisen solely through carelessness on the part of the individual worker and this fault must also have been primarily responsible for many of the other types of accident occurring in these purely mechanical operations.

Turning to the classes of accidents more specific to the chemical industry, it is found that 113 were due to explosions or fires, 48 to gassing and 502 to molten metal, hot or corrosive substances. Chemical processes which involve the use of new products sometimes give rise to injury as the physiological effect of the new substance is not fully known. In many cases preliminary experimentation with animals does not give a true indication of the effect to be expected on the human. Medical supervision of persons using these substances is an aid in the protection of the worker and the new Act now requires it in cases where it is thought necessary.

Dermatitis, one of the most prevalent diseases in the chemical industry, last year reached the highest figure yet recorded, alkalies being far and away the most common causative agents. Here again the new Act will probably prove helpful in requiring the provision of extended washing facilities. It is believed that a suitable "barrier" substance for the prevention of dermatitis has now been worked out and, if satisfactory following practical test, it will be described in official notices.

Although the new Act will be effective in reducing the number of certain accidents, it will have no effect on those primarily due to carelessness. Obviously no kind of legislation can place an effective check on this type of mishap; this can only be brought about by every worker taking care for himself and exercising forethought for the safety of others. Works safety organisations and committees are an excellent way of instilling this point of view into the minds of the workers; they are constituted differently according to size of works but must always have the keen interest of the management and at least one workman on the committee.

Safety organisations cannot be really effective unless the management is keenly interested in safety and is willing to help in every possible way; unfortunately there are some organisations which do not have this support and they practically exist in name only.

H. H. C. Thomas.

Notes and Comments

Colonial Trade Expansion

IN these days of restricted international trade it is refreshing to see an all-round increase of British Colonial trade recorded in the economic survey of the Colonial Empire for 1936, issued by the Stationary Office. Development in the export trade of colonial products creates new outlets for the manufactured goods of this country as well as providing an increased supply of raw materials. Exports rose from £239 millions in 1935 to £259 millions in 1936, and imports from £227 millions to more than £247 millions. Exports of mineral products, many of them raw materials for chemical manufactures, rose from £29 millions to £44 millions, an expansion of over 50 per cent; tin was the most important individual product, followed by copper, gold and petroleum. An interesting reference is made in the report to the recent development of manganese, iron ore, and phosphates of lime which are now included in the list of important Colonial commodities. Any discovery of new Colonial sources of materials, work in which the Imperial Institute plays a useful advisory part, is a reassurance at a time when raw material supplies appear to be so vital to a nation's security.

Glass Technology

THE Department of Glass Technology of Sheffield University issues each year a volume of experimental researches and reports, being a collection of reprints of papers appearing in scientific journals and describing investigations done by members of the department. The present volume for 1937, which has just been issued, runs to 300 pages and contains 21 papers collected from *The Journal of the Society of Glass Technology* and *The Glass Review*. The first paper in the book is an interesting communication prepared by Professor W. E. S. Turner for the 21st anniversary celebrations of the department; it is an account of its foundation and work since 1915. The other papers are of a technical nature and deal with such subjects as the use of special alloys in the glass industry; the possibility of preparing glasses containing P_2O_5 , Al_2O_3 , B_2O_3 and SiO_2 ; the crystalline products in commercial glasses; determining the thermal endurance of glass; chemical analysis of glasses, silicates, and glass-making raw materials; and the chemical properties and chemical testing of glass. Reports of investigations concerned with a common subject when bound in a single volume form a most handy source of reference. It is a plan which could be followed with advantage by many organisations similar to the Department of Glass Technology at Sheffield.

Cambridge Meeting of the British Association

THE Cambridge meeting of the British Association for the Advancement of Science, which opens on Wednesday and continues until August 24, has a very full programme before it. Science, in all its branches covers such an enormously wide field that a comprehensive review of all recent scientific achievements would be quite beyond the scope of any meeting. But a glance at the list of papers to be read at the Cambridge meeting shows what an extraordinary amount of ground is covered, mainly in academic research. In the Chemistry section, a variety of subjects will be treated. In his presidential address to the section, Professor C. S. Gibson will describe recent advances in the chemistry of gold, and this will be followed by a discussion on the recent advances in the organic

chemistry of the metals, with special reference to the noble metals. Dr. J. J. Fox, Government Chemist, will open a symposium on modern methods of chemical analysis and three of the contributions will deal with spectrochemical analysis, inorganic and organic spot-analysis, and micro-analysis respectively. Professor W. L. Bragg, Dr. G. Nagelschmidt, Dr. R. K. Schofield, and Professor J. D. Bernal will read papers in a discussion on clays, their subject-matter including the structure of silicates and clay minerals, the origin of the electric charges on clay particles, and the hydroxyl bond in clay minerals. The closing day of section's programme promises to be most interesting. It will be devoted to a discussion on the repercussions of synthetic organic chemistry on biology and medicine. The importance of chemistry to medicine in providing new synthetic drugs is a feature of recent date, and the progress in this field, described at the Association's Nottingham meeting last year, has been remarkable. The discussion to be held this year is on a closely-related subject. An important proposal to the Association for the establishment of a division to deal with the social and international relations of science will be considered. The effects of the advances of science upon the well-being of the community, and, reciprocally, the effects of social conditions upon advances in science are the principal problems to be investigated by the proposed division.

American Drug and Cosmetic Legislation

THE recent U.S. Food, Drug and Cosmetic Act introduces important changes in the provisions relating to the labelling of drugs and cosmetics. It is now held to be an offence to make false claims, whether those claims are made with fraudulent intent or not, of the curative effect of patent medicines. This is an important step protecting both the public and the reputable manufacturer. In this country, however, the new Food and Drugs Act, which has just received the Royal Assent, leaves the position just as it was in this direction. From the legal point of view it still has to be proved that false claims of a product's properties were made as deliberate mis-statements. Another important section of the new American Law prohibits the sale of a new drug until the authorities are satisfied that the substance is safe when used according to the directions on the label. The extravagant claims made for cosmetics in America are now a thing of the past. All cosmetic preparations, excluding toilet soap, must now do what they claim; their labelling must not be "false or misleading in any particular."

The Chemical Age Lawn Tennis Tournament

THE finals of the eighth annual CHEMICAL AGE Lawn Tennis Tournament will be held at Alderbrook Park, Cranleigh, Surrey, on Saturday, September 3, by kind invitation of Mr. A. Van den Bergh, chairman of Van den Berghs and Jurgens, Ltd., and joint vice-chairman of Lever Brothers and Unilever, Ltd. Play will commence at 2.30 p.m. Full particulars of the arrangements, including travelling facilities, were published in last week's issue. A number of invitations have been sent out, and members of the chemical industry wishing to attend should apply for tickets as soon as possible. Applications should be addressed to the Editor, THE CHEMICAL AGE, Bouverie House, 154 Fleet Street, E.C.4.

Gas Absorption in Wet Cyclone Scrubbers*

By

H. F. JOHNSON and R. V. KLEINSCHMIDT

VARIOUS types of spray tower have been suggested for use in gas absorption. Theoretically it would be expected that atomisation of the absorbing liquid would provide a large surface of contact, and that such a surface travelling through the gas would be ideal for the absorption of very soluble gases. Measurements made on single droplets of known size have verified this to the extent of proving the existence of a high absorption coefficient. In practice, however, simple spray towers have not met with the favour that the theory would apparently justify. Their use is limited to a few industries in which large quantities of solvent can be circulated, and to certain types of humidification and dehumidification equipment. In the chemical industry they have proved poor competitors to packed absorption towers. Even for the treatment of large volumes of gases, for which they would apparently be ideally suited because of their simplicity and low pressure loss, their use has been dismissed as ineffective. (*J. Inst. Fuel*, 1935, 8, 119). Unfortunately, most of these towers have been designed by the "rule of thumb method" without thorough appreciation of the effect on the efficiency of the absorber of such factors as the size of the spray droplets, their interfacial velocity, the number of droplets per unit volume of scrubber, and the mechanism of mass transfer to the liquid surface.

Absorption Coefficients

Actual data available on absorption coefficients in spray towers are mostly limited to measurements made in small towers, in which the effect of the wall and of the type of spray nozzle is so great that it is impossible to draw any conclusions as to the exact performance of the spray itself. A few measurements on a large spray tower of conventional design, which are available to the authors, indicate that the rate of absorption was high immediately in front of the nozzles but that it dropped off rapidly with distance. While the size distribution of the droplets from the nozzle was not known, it is obvious that the smallest particles, which were the source of the major portion of the absorption, lost their initial kinetic energy and could not penetrate more than a few feet into the gas.

The development of the wet cyclone washer for the removal of dust from gases has suggested that the high velocities of the small droplets, resulting from the centrifugal action of the gases, might be conducive to rapid gas absorption. Such a washer consists of a vertical cylindrical shell with a tangential gas inlet at the bottom and a central gas outlet, with straightening vanes, at the top. The water used for removal of dust from the gases is circulated through the washer by means of a centrifugal pump. After leaving the washer, it passes into a settling cone from which the underflow carries the dust collected by the spray particles. Make-up water is required in proportion to that lost by evaporation and in the underflow.

Experimental Tests

Desiring to test the possibility of using such a washer for gas absorption when treating large quantities of dilute gases, the authors were fortunate in having an opportunity to study the performance of two units from this standpoint. These washers normally operate for the sole purpose of dust removal. The removal of sulphur dioxide from the gases is limited by the solubility in the small amount of water wasted from the system. The general programme of the test, therefore, at first consisted in adding a solution of sodium carbonate to the circulated water at such a rate as to keep the effluent from the washer definitely on the alkaline side of neutrality. Later the pH was changed to 5.3-6.5. The re-

sults indicate the maximum efficiency of the scrubber when absorbing a very soluble gas with no liquid film resistance, since the absorption of sulphur dioxide by alkaline solutions has been shown to be independent of this film (*Ind. Eng. Chem.* 1937, 29, 286). They further indicate that this film does not affect the absorption when the solution is on the acid side, but still contains sufficient sulphite ions to produce the partially buffered effect desirable for a cyclic process for absorbing sulphur dioxide (*ibid* 1938, 30, 101) since the results were essentially the same for both cases.

The two washers operated as a single unit on the gases being treated for dust removal. Each washer discharged into its own settling cone and the overflow from these passed to a single pump which sent the solution to the nozzles at 45 lb. per sq. in. Make-up water was added in front of the pump. The washers themselves were 10.3 ft. internal diameter, and 20 ft. high. They were lined with acid proof brick to prevent corrosion by the acid water normally circulated. The central manifold in each scrubber was equipped with 80 lava nozzles of the Sturtevant type with 3/16 in. orifices. These nozzles were set so that they led the gases. To prevent interference with the normal operation of the plant during the test, conditions were taken as they were found. For this reason it was not discovered until a few days after the test that eight of the nozzles in one washer and 44 in the other were clogged, a condition resulting from eight months' previous operation. For a similar reason, it was not discovered until later that dust accumulations in the tangential entrance to one washer was slightly more than it was in the other. These entrances are normally 52 in. high and 37 in. wide.

Efficiency Measurements for Two Scrubbers

It was observed during the test that the one washer (designated as "Right"), taking the smaller amount of gas with the smaller amount of water, gave slightly lower removal efficiency than the other (designated as "Left"). The difference was attributed to the lack of uniform distribution of the solvent. Since measurements were made only on the total flow to the two scrubbers, a proportioning was made on the basis of the number of nozzles operating and the relative open areas of the gas entrances. It was concluded that the "Right" washer operated on 44 per cent. of the gas with one-third of the solvent, or 50 gal. per minute; the "Left" washer operated on 56 per cent. of the gas with two-thirds of the solvent, or 100 gal. per minute.

During the test the inlet gas rate to the two scrubbers was varied from 60,000 cu. ft. per min. at 413° F. to 105,000 cu. ft. per min. at 471° F. The quantity of solution in circulation was approximately 38,500 lb. The rate of circulation was maintained constant at 150 gal. per minute. The rate was obtained from a power meter installed on the pump motor and the efficiency curve for the pump. It was inadvisable to insert orifice meters in the lines for the test, owing to the fact that all pipes were rubber lined and permanently installed. Make-up water was added from the city water main through a meter.

The rate of underflow from the settling cones was determined by actual measurement at intervals during the test. In spite of this fact, however, the water balance on the test was not good, there being approximately as much water accounted for in the evaporation alone as was added as make-up. It was planned also to make a sulphur balance, but it was found that this was impossible due to the volume of the solution in the settling cones, which varied in composition from top to bottom and as the test progressed. Unfortunately, this prevented the determination of the percentage of the sulphur dioxide oxidized to sulphate in the absorption.

*From *Chemical and Metallurgical Engineering*, 1938, 45, No. 7.

This would be important information from a large scale test. These inadequacies, of course, have no bearing on the real purpose of the test, which was to determine the efficiency of the washer as a gas absorber. This was found directly from gas analyses made as described below.

Gas temperatures were taken at frequent intervals by means of calibrated thermocouples at suitable points across

The principal results of the test are shown in Table I, together with the conditions prevailing at each time interval. The volume absorption coefficient, K_gA , was calculated from the gas composition, the rate of gas flow, and the assumption that the equilibrium vapour pressure of sulphur dioxide over the solution was zero. The per cent. humidification represents the actual change in moisture content compared with the total change if the gases had been reduced to the wet-bulb temperature.

The results show that the percentage removal of sulphur dioxide in the right washer, operating with partially clogged nozzles, was approximately 85 per cent., while that in the left washer, which received nearly twice the volume of solvent, was better than 95 per cent. The absorption coefficients for the two washers are in fact almost in proportion to the quantity of solvent each received, the average being, respectively, 1.58 and 4.05. There is no evidence of a decrease in the absorption coefficient as the pH of the solution entering the washers was decreased from 8.4 to 5.8. Below this value, however, the efficiency of the washers decreased rapidly, evidently due to a finite vapour pressure of sulphur dioxide over the solution as the bisulphite point is approached.

While the data are insufficient to show definitely that the velocity of the gases through the washer is without effect on the absorption coefficient, it is evident that this effect cannot be large as a two-fold change in the gas flow decreased it only slightly.

It is interesting to note that the humidification efficiency of the washers agreed closely with the efficiency of sulphur dioxide removal, the actual values running slightly above the absorption percentages. This agrees with the expectation that the evaporation of water through a film of gas proceeds slightly faster than the transfer of sulphur dioxide due to the greater diffusivity of the molecules of

TABLE I.—PERFORMANCE OF CYCLONE SCRUBBERS AS GAS ABSORBERS IN REMOVING SULPHUR DIOXIDE FROM GASES BY SODA ASH SOLUTION.

SULPHUR DIOXIDE FROM GASES BY SODA ASH SOLUTION.										
Time	Gas Rate, Cu.Ft./Min. at 60° F.	Solution, pH	Wash- er	Gas						Experimental Coefficients, K_gA , lb. moles (hr.) (cu. ft.) (atm.).
				Temp. Gas, °F		Per Cent. Humidi- fication	SO ₂ Per Cent. by Volume (dry basis)		Per Cent. Re- moval	
				In	Out		In	Out		
10.20	45,700	2.8	R†	—	—	—	0.0555	0.0462	16.8	—
11.05	Na ₂ CO ₃ started									
11.15	45,700	4.0	R	448	162.0	89.1	0.0545	0.0088	83.9	1.84
11.37	45,100	8.4	R	449	162.5	89.5	0.0577	0.0096	83.3	1.74
12.00	46,800	8.3	R	448	164.7	88.9	0.0558	0.0082	85.3	1.96
12.25	46,200	8.1	R	446	161.0	89.8	0.0544	0.0096	82.5	1.76
12.46	45,100	7.9	R	445	162.0	89.5	0.0550	0.0119	78.3	1.54
1.15	44,000	7.4	L‡	444	136.7	98.7	0.0409	0.0023	94.5	3.47
1.40	59,400	7.0	L	468	135.0	99.5	0.0574	0.0019	96.6	5.50
2.00	58,500	6.9	R	475	169.2	88.5	0.0579	0.0135	70.7	1.47
2.30	38,600	6.8	R	460	169.2	88.1	0.0507	0.0117	77.0	1.96
2.58	Na ₂ CO ₃ stopped									
3.23	33,900	5.8	L	405	139.0	99.5	0.0696	0.0027	96.0	2.98
3.43	Na ₂ CO ₃ started									
3.50	33,900	5.5	R	400	155.0	90.1	0.0700	0.0189	73.0	0.99
4.10	33,500	6.4	R	400	155.5	89.7	0.0734	0.0188	74.2	1.00
4.33	32,700	6.4	L	400	140.0	94.5	0.0701	0.00017	99.6	5.15
4.45	Na ₂ CO ₃ stopped									
5.00	33,500	6.4	L	400	140.0	94.5	0.0683	0.0022	96.8	3.11
5.21	33,500	5.6	L	400	140.0	94.5	0.0700	0.0391	44.2	—
5.45	33,500	5.0	L	—	—	—	0.0672	0.0610	9.23	—
6.05	27,000	4.8	L	—	—	—	0.0516	0.0603	—	—

*Average: Left Washer = 4.05; Right Washer = 1.58.

†Right Washer operated on 44 per cent. of the gas with 50 gal. water per min.

‡Left Washer operated on 56 per cent. of the gas with 100 gal. water per min.

the inlet and outlet ducts of the washer. The temperature of the effluent water from both washers was approximately constant. This was taken as the wet bulb temperature of the gas. The humidity of inlet and outlet gas streams from each washer could then be determined from the actual gas temperatures and from these the efficiency of humidification found. The high temperature humidity chart of Lavine and Sutherland (*Chem. and Met.*, 1928, 35, 224) was used in these calculations.

Samples of the overflow from one settling cone were taken every five minutes during the test and the pH and sulphite and bisulphite ion concentration determined immediately. The total sulphur concentration, from which the sulphate ion content was found by difference, was determined later gravimetrically. The pH was determined colorimetrically using standard indicators. Total sulphur dioxide was determined iodimetrically and bisulphite was found by titrating a sample with standard hydroxide after oxidation with neutral hydrogen peroxide. Sulphite was then found from the difference in these values.

Gas analyses were made on the inlet and outlet to each washer during the test. The sampling tubes were $\frac{1}{2}$ in. lead pipes extending to points near the middle of the ducts. Simultaneous samples were drawn from the two positions by means of two small motor-driven vacuum pumps. The gas passed first through bottles of glass wool, then through standard sodium hydroxide containing excess hydrogen peroxide. From this point the blowers discharged through dry gas meters. The titration of the excess hydroxide in each bottle gave the volume of sulphur dioxide, and this, with the corrected volume of inert gas from the gas meters, gave the volume percentage of SO₂.

TABLE II.—DISTRIBUTION OF SIZE OF WATER DROPLETS FROM NOZZLES; AND THEORETICAL ABSORPTION COEFFICIENTS DURING TESTS.

(Sturtevant nozzle No. 2 in lava at 65 lb. per sq. in. and 60 deg. F.)

Diameter of Drops*, Microns	Number of Drops Measured	Number per Cc. of Spray†	Per Cent. of Volume	Area per Cc. of Spray, Sq. Cm.	Per Cent. of Area	Theoretical Coefficients	
						K_gA	Per Cent. of Total.
25	878	97,250	0.072	1.9	1.48	0.778	30.7
50	460	51,000	0.334	4.0	3.12	0.589	23.2
100	190	21,000	1.11	6.6	5.15	0.341	13.4
150	89	9,850	1.75	6.9	5.38	0.194	7.6
200	53	5,870	2.46	7.4	5.78	0.135	5.3
250	33	3,650	3.00	7.2	5.61	0.094	3.70
300	22	2,440	3.46	6.9	5.38	0.069	2.72
350	16	1,770	3.97	6.8	5.30	0.0532	2.10
400	13	1,440	4.83	7.2	5.61	0.0465	1.83
450	11	1,220	5.84	7.8	6.09	0.0415	1.63
500	10	1,107	7.25	8.7	6.79	0.0400	1.58
550	8	886	7.74	8.4	6.55	0.0335	1.32
600	7	776	8.79	8.8	6.87	0.0312	1.23
650	6	664	9.59	8.8	6.87	0.0275	1.08
700	5	554	9.68	8.5	6.64	0.0238	0.94
750	4	443	9.84	7.8	6.08	0.0198	0.78
800	3	332	8.94	6.7	5.22	0.0153	0.60
850	2	221	7.13	5.0	3.90	0.0105	0.41
900	1	110	4.22	2.8	2.18	0.0054	0.21
950	0	0	0	0	0	0	0.0
1,200	0	0	0	0	0	0	0.0
1,811	200,583	100.00	128.2	100.00	2,540	100.0	

*Each size group includes drops in a range equal to the interval between groups, containing about the nominal size, i.e., the "100" group includes drops from 76-124 microns.

†Number of drops of each size produced by each Cc. of spray.

water vapour. From a practical standpoint this fact is of importance as it proves that it is impossible to remove sulphur dioxide from a gas by this method without saturating the gas with water vapour simultaneously.

Evidence of the small oxidation of the dissolved sulphur dioxide was shown by an increase in sulphate content of the overflow solution from 0.014 moles per litre to a maximum of 0.053. On the other hand, the total SO_2 increased from 0.0008 to over 0.2 moles per litre. As mentioned above, it is impossible to determine the exact percentage oxidation as the composition of the entire solution was not known.

During the period of the test 17,141,000 cu. ft. of gas (60°F.) was washed, using 121,676 lb. of make-up water to which 1,679 lb. of soda ash was added. It was calculated that 96,715 lb. of water was evaporated and that 1,329 lb. of sulphur dioxide was absorbed. The values for make-up water and water evaporated should be accurate and their difference should correspond to the water lost in the underflow and by spray. Since this difference was small in any case, the loss by spray could not have exceeded a fraction of a per cent. of the total water circulated. The quantity of sulphur dioxide absorbed, calculated from the gas analysis, followed the equivalent quantity of soda ash added, the ratio becoming greater than unity when the sulphite ratio of the solution was exceeded, that is, when sodium bisulphite was being formed.

Discussion of Results

In order to be able to apply the results of this test to the design of similar scrubbers for other quantities and compositions of gases, it is quite important to have some working theory of the operation of the scrubber. This requires a knowledge of the size of the droplets, their speed through the gas, and the mechanism of absorption by a spray droplet.

The authors have been fortunate in obtaining some measurements on the size distribution of the droplets leaving the nozzles. The measurements were made on a new nozzle of the same type as that used in the test. The pressure on the nozzle was 65 lb. per sq. in. to compensate for the difference in temperature, which was 60°F. The results of these measurements are shown in the first several columns of Table II. They are interesting as they show the extremely large number of particles per unit volume of liquid that can be produced by a simple spray. Similar measurements on another type of lava nozzle produced even greater atomisation. It is to be noted that while the number of drops in the small sizes is very large, their fraction of the total volume is small. On the other hand, there is a fairly uniform distribution of area between the sizes of 100 and 800 microns.

Little is known of the velocity of particles in a cyclone washer, particularly of such non-rigid particles as droplets of a liquid which are known to be distorted at high velocities by the resistance of the gas. Calculation of the radial velocities according to the method of Anderson, assuming rigid spheres of unity specific gravity, gives velocities for the larger particles that are impossibly high. However, droplets below 200 microns in diameter appear to reach velocities agreeing closely with Stokes' Law. In order to calculate the theoretical volume absorption coefficient given in column (7) of Table II it was necessary to calculate theoretical radial velocities of the various sizes of droplets, from which the time of contact with the gas could be determined. Recognising that the Stokes' law velocities for the larger droplets must be much higher than actual, it is clear that contact times so obtained must be too low, and that the coefficients so calculated are also too low. The experimentally determined coefficients show this to be the case.

Because of the instability of water droplets travelling at high speeds, it is considered quite probable that further atomisation takes place in the scrubber after the particles leave the nozzle. Just what is the limiting velocity for stability cannot be stated, but it is evidently greater than 65 ft. per second as small droplets will be more stable than large ones due to surface tension. Atomisation to even 300 microns, however, would greatly increase the number of droplets and decrease the velocity. Both of these factors tend to increase the absorption efficiency.

Drug Sales in India

New Regulations for Labels on Packages

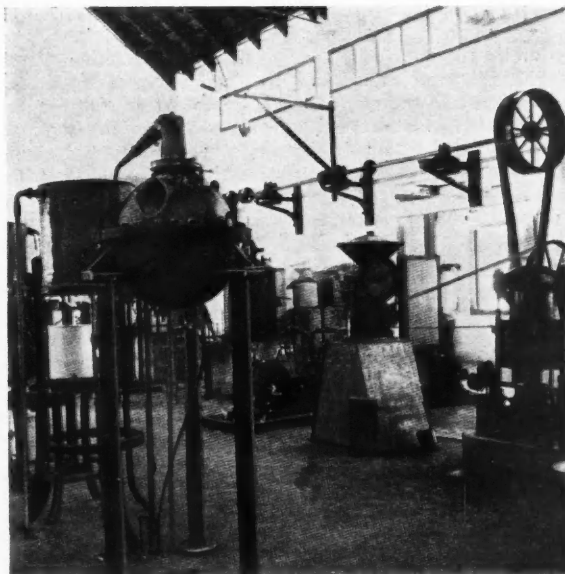
THE American Trade Commissioner at Calcutta, the Association of the British Chemical Manufacturers (London), the Wholesale Drug Association (London), the Proprietary Association (London), the Bengal Chamber of Commerce, and the Calcutta Trades Association have put up strong objection against the by-laws which the Corporation of Calcutta proposes to enforce with a view to regulating the fixing of labels on packages of food and drugs. These by-laws enjoin that no person shall sell in a package any food or drug, or any compound or mixture thereof or shall keep or expose for sale in a receptacle any food or drug unless such package or receptacle is labelled properly. The prescribed label must, among other things, set out in print the description of the food or drugs, the place of manufacture or the country of origin, the name and address of the manufacturer, the date of packing or manufacture, and the trade name.

Vanadium Pentoxide

A Modified Catalyst for Sulphur Trioxide

THE development of a modified vanadium pentoxide catalyst for the manufacture of sulphur trioxide is reported by Adadourov and Sedasheva (*J. Appl. Chem. U.S.S.R.*, 1938, 11, 598-603). The ordinary vanadium pentoxide catalyst masses have a low volume velocity constant for the oxidation of sulphur dioxide, because of the slow rate of desorption of the trioxide produced, whereby the free surface of the catalyst is much reduced. The actual speed of conversion is very high.

A catalyst with a large active surface and on which the trioxide is poorly absorbed has been discovered in a chrome-vanadium-antimony combination. This has, at 450° , a higher velocity constant than that of any known contact mass for the oxidation of sulphur dioxide. Its volume velocity constant is 100 per cent. greater than that of the ordinary mass, with a 95.3 per cent. efficiency of conversion.



A view of the Technology Division of the Government Department of Science, Bangkok, Siam. According to the Department's 8th report just received, covering the period April 1, 1934 to March 31, 1936, the output of vitamin B extracts in this division during the period was the highest so far attained. The distribution is in part through the Government dispensaries and in part directly to the public. The manufacture of hydnocarpus ethyl esters for the treatment of leprosy is now carried out in the division and further expansion is being considered.

Anglo-Argentine Trade

From a Special Correspondent

THE appointment of Dr. Tomas Le Breton as the new Argentine Ambassador in London, foreshadows discussions on the future of the Anglo-Argentine Trade Agreement which will expire next year. Dr. Le Breton was in charge of the negotiations in 1936, when the original treaty was renewed for a further three years.

For some years before the conclusion of the first (Roca-Runciman) Anglo-Argentine Convention in 1933, exporters from the United Kingdom were finding it increasingly difficult to obtain their share of business with Argentina. This was partly the result of the large increases in protective duties which inevitably followed the fall in the world demand for Argentina's agricultural products, and partly the result of the consequent shortage of foreign exchange which subjected payments for goods to increasing delays and in some cases rendered business impossible.

In the spring of 1933 a trade mission was dispatched from Argentina, headed by Vice-President Roca. The negotiation of a treaty with Great Britain had been contemplated a year before, but was delayed in view of the Ottawa Conference, at which the meat problem figured prominently on the agenda. Our abandonment of Free Trade had impressed Argentina with the need for securing her position with her biggest customer, while the British Government properly felt that some reciprocal advantage should be obtained for our exports. This mutual problem was largely solved by the Roca-Runciman treaty, which enabled British interests to liquidate £10,000,000 of their holdings in Argentine currency.

During the next two years, the treaty resulted in a steady increase in British exports to the River Plate, the 1935 total of £15,607,000 being no less than 50 per cent. higher than the corresponding figure for 1932.

When the renewal of the Treaty became due for discussion in 1936, there were grave misgivings among Argentine farmers when they learned that the British Government intended to put a duty on imports of their meat into the United Kingdom. The increase in British exports to the River Plate since 1933 had been coupled with a decrease in our imports of foreign meat, as the Empire farmers were sending us larger supplies. Argentine critics of the treaty not unnaturally suggested that the Englishman was getting it both ways. However, as the United Kingdom was still the only free market in the world for their produce, a duty on beef of 3d. per lb. was accepted by the Argentine negotiators, who were reminded that their Government had imposed duties on British goods for many years, notwithstanding that Britain was far and away the largest buyer of Argentine goods.

In view of the almost phenomenal increase in exports from the River Plate in 1937, it is not surprising that Argentine purchases from Britain last year rose to little short of £20,000,000, an increase of £4,500,000 over the 1935 total.

Those who argue that Argentina's visible and concrete imports from this country should precisely balance our purchases of her meat, cereals, and other produce overlook the fact that interest can only be paid in goods, so that from the standpoint of the investor a further increase in Anglo-Argentine trade is highly desirable. The British Exchequer benefits, of course, from these dividends. Our railways and other undertakings in Argentina during the ten years up to 1930 bought equipment from British factories for an average of £8,000,000 per annum, and last year these purchases were resumed on an encouraging scale.

The need of the future is surely to export more British goods to Argentina, rather than to reduce our imports from the River Plate, which have hitherto brought the advantages of cheap meat to the poorest section of our population, employment for our shipping, dividends for our investors, and valuable orders for our manufacturers. A prosperous trade between two countries with similar ideals and interests is a strong factor for peace.

Cellulose Acetate Films

Effect of Plasticisers on Properties

ACCORDING to Z. G. Ivanova (*Promyslennost' organicheskoi khimii*, 4, 371) prepared cellulose acetate films of 120 μ thickness have been prepared on glass plates with a acetone-alcoholic solution of 18 per cent. of cellulose acetate, containing 0 to 36 per cent. of different plasticisers.

The films were examined after ageing under ordinary conditions, and after being treated for 3 days at 100°, with and without preliminary immersion in water for 2 days, and after being exposed to air with 60 per cent. humidity.

The compatibility of cellulose acetate and the plasticisers in the films was tested between -60° and 60°. The compatibility depends upon the nature of the plasticisers, and upon the degree of cellulose esterification. The films containing 42 per cent. triphenyl phosphate separated, after a period of 2 to 3 months layers of plasticiser, while films containing tritolyl phosphate and dimethyl glycol phthalate separated oil. Addition of small amounts of all plasticisers improved the mechanical properties of films of low acid numbers. The addition of 24 per cent. of *p*-methylenbenzylsulphamid gave a maximum increase of the strength with a considerable decrease in the stretching capacity.

Glycol phthalate decreased the mechanical strength of films with high acid number. Of the phosphate group triphenyl phosphate increased to a maximum the mechanical strength of film without affecting its stretching power. It is superior in stability and resistance to water and air humidity. Of the phthalate group the dimethyl compound is an excellent gelatinising agent. It is capable of improving the compatibility of non-gelatinising plasticisers and the transparency of films and solutions. It increased considerably the stretching power, but decreased the film strength. The strength of films without plasticisers, and with dimethyl- and dimethyl glycol-phthalate is increased by the thermal treatment (with and without preliminary heating in water); the strength of films with tritolyl- and triphenyl phosphate is decreased owing to the destructive action of the liberated phenols and cresols.

Tributyl phosphate and dimethyl phthalate alone, and in films lost, when heated at 60° (60 per cent. humidity) for 10 days 5 to 5.5 per cent. in weight, dimethyl glycol phthalate and *p*-methylenbenzylsulphamide lost 0.4 to 0.5 per cent. (but little volatile), tritolyl phosphate lost not at all, while triphenyl phosphate increased its weight, the two latter because of partial oxidation. The evaporation of the solvent was studied by heating cellulose acetate without plasticisers and with different amounts of triphenyl phosphate and dimethyl phthalate for varying times. The untreated films retain the residual solvent even after a period of 25 days of drying, and with increasing concentration of plasticisers the rate of the evaporation of the solvent increases.

Salters' Institute

Fellowships Awarded for 1938-1939

THE following awards for 1938-39 have been made by the Salters' Institute of Industrial Chemistry and approved by the Court of the Salters' Company.

Fellowships have been renewed in the case of Messrs. A. J. Shorter (at Illinois University), J. L. Tuck (at Oxford University) and to S. H. Wade (at Imperial College, London).

Fellowships have been awarded to H. D. Anderson (Oxford University), A. Cameron (Imperial College, London), H. S. Corran (Cambridge University) and R. N. Haward (Cambridge University).

The Salters' Institute has also awarded 50 grants-in-aid to young men employed in chemical works in or near London, to assist them in their studies.

Some Industrial Applications of Quaternary Amines

By
J. WAKELIN

THE simplest typical quaternary ammonium compound, tetramethyl ammonium hydroxide, $N(CH_3)_4OH$ is known to have alkaline properties and to be soluble in water, but beyond a few isolated instances of its use in analysis, comparatively little utilisation is made of the compound. There are innumerable substituted forms and homologues which are of much greater interest, however, and some which lately have been shown to be of value in a number of different phases of industry and manufacture.

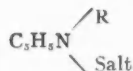
Trimethylbenzyl ammonium hydroxide, for example, has been shown to be a solvent for cellulose and a very suitable medium in which to etherify cellulose. (Bock, *Industrial and Engineering Chemistry*, September, 1937). When cellulose is treated with methylating (or ethylating) agents, such as dimethyl sulphate, in the presence of caustic alkali, an ether of cellulose is formed. The solubility qualities of the resulting cellulose ether depend upon the degree of etherification obtained. When comparatively few of the hydroxy groups in cellulose are affected, the product is of poor solubility in most solvents except perhaps caustic soda. Increasing etherification brings about progressively greater solubility in water and if carried still further, the ether dissolves in organic solvents.

Solubility Properties Sought

In the present case solubility in water is the property sought. Bock shows that a quaternary ammonium compound supersedes alkali as a solvent or medium for cellulose in etherification because with the quaternary compound the product is more soluble for a given degree of etherification than is the case when alkali is employed. Naturally this advance makes for economy in materials, for example, in the methylating agent. At first sight it appears paradoxical that a given process like etherifying cellulose should be capable of so simple and extraordinary improvement. It is suggested that whereas alkali merely swells cellulose, the quaternary dissolves it so that when the etherifying agent is added the chemical combination which follows takes place more uniformly, and thus its influence on the properties of the resulting cellulose ether is felt with greater force.

The cellulose power of a quaternary ammonium hydroxide for cellulose is a possible means of manufacturing artificial filaments and foils in like manner to viscose and cuprammonium. Rohm and Haas of Philadelphia have disclosed in a patent the fact that diethylphenylbenzylammonium hydroxide will dissolve cellulose and that the solution may then be extruded via jets into a dilute acid bath to give artificial filaments. While this procedure can hardly be considered as a serious competitor to the viscose process, it may be capable of adaptation in specialised fields where viscose is not suitable.

When one of the alkyl groups in a quaternary ammonium compound is a fatty alcohol radical, such as dodecyl, cetyl or oleyl, a truly enormous field of possibilities is opened up. These alcohols are, of course, the alcohols corresponding to certain fatty acids and are derived from them by hydrogenation. So far it has been assumed that the compounds under discussion have the configuration of ammonium salts, but no such limitation exists in fact. The nitrogen atom upon which the compound is built may be a member of a heterocyclic ring system, such as pyridine. In which case the compounds are spoken of as alkyl pyridinium compounds and the general formula conforms to:



R may represent any alkyl group, as for instance cetyl, $C_{16}H_{33}$, whilst the "salt" is chloride, bromide or bisulphate.

If 8 parts of pyridine are heated with 25 parts (by weight) of dodecyl bromide at 120 to 130° C., the mixture reacts and gradually becomes water soluble. A sample is withdrawn for test at intervals until reaction is complete, and the material cooled. It is a glassy solid which dissolves readily in water and exhibits soap-like properties, which, incidentally, are not affected by acids or lime.

The detergent qualities of this and similar substances is illustrated by reference to the washing of raw, limey wool. 1,000 parts of wool are treated in a warm bath of 50 parts stearyl pyridinium bromide in 50,000 parts of water. 300 parts of hydrochloric acid (36° Tw.) is added, and although the bath is freely acid it lathers and cleanses the wool in less than 30 minutes. It is rinsed free from acid and when dry the wool is found to be clean and to have an excellent "handle."

Quaternary compounds like that described above may be used in preparing emulsions and they possess the distinctive feature of ionising in such a way that it is the cation and not the anion (as in soap and sulphated fatty alcohols) which possesses the surface active colloidal powers. In fact, quaternaries possessing an electrically oppositely charged ion to soap may be made to neutralise or even to precipitate soaps and similar colloids. Some writers have described these quaternaries as "cationic" or reversed soaps.

How dodecyl pyridinium bisulphate may be used for preparing an emulsion of paraffin oil may be quoted as an example. 700 grams of the latter are emulsified in the cold with 140 grams of sodium dodecyl sulphate in a boiler provided with stirring gear. Dodecyl pyridinium sulphate is next added until the paste has the maximum viscosity, at which point the brine which has formed may be separated by heating. The electro-neutral compound which, it is stated, occludes the paraffin may be converted into a positively charged emulsion by further addition of the pyridinium sulphate, or into a negatively charged emulsion by adding sulphated fatty alcohol. (British Patent 442,466).

Possibilities of Cationic Soaps

The possibilities in these cationic soaps are by no means exhausted in the field of emulsion preparation. Study and research will no doubt yield numerous other applications. Of quite recent date is the announcement that rubber latex may be applied to wool and other textiles by their aid. The emulsified particles of rubber in latex are negatively charged and may be "deposited" by a process akin to electrical deposition developed by the Wool Industries Research Association. By one route the textile fibre is treated with cationic soap such as cetyl pyridinium bromide, whereby it acquires an electropositive charge, being strongly adsorbed. On immersing it in rubber latex the rubber particles are electrically attracted to it and deposit themselves thereon. When the fibre is withdrawn again, the latex is substantially "exhausted" of rubber. Alternatively, the rubber latex itself is treated with cationic soap in excess of the amount required to cause flocculation, and the result is a stable "reversed" latex the particles of which are positively charged. On contact with a textile fibre which has not been previously treated, such a latex gives up its rubber.

The rubberised textile fibre is not affected by washing, for the deposition is not reversible. Not only is the bond between rubber and fibre electrical, but the fatty elements in the cationic soap dissolve in and merge with the rubber providing an extra bond between the two.

Apart from the interest this discovery has for the textile industry, it is also of wider interest to the rubber user and its general implications are still wider and embrace many industrial spheres. Further reports on cationic soaps will be eagerly awaited by a great many.

Annual Meeting of Benn Brothers, Limited

Revenue of the Business Maintained in a Year of Additional Expenditure

THE forty-second annual general meeting of Benn Brothers, Limited, the proprietors of THE CHEMICAL AGE was held on August 5, at Bouverie House, Fleet Street, London.

SIR ERNEST BENN, the chairman of the company, who presided, said that the business had experienced none of the industrial depression talk of which had been current through the year under review. That did not mean that the business had not had a hard year. It had had a year in which it had had to shoulder much additional expenditure, and had managed to maintain its revenue. The directors were rather proud to be able to present a report which compared favourably with some of the reports, especially publishing reports, that had recently been issued.

There was a good deal of talk about this theory of an industrial depression which, in his view, it was hard to justify. The Prime Minister in a speech within the last few days had been at great pains to show that all the factors which were towards prosperity were good, and that there was no basic reason why there should be any depression. The theory of a European War which was a good reason a year ago for thinking that we might be in for commercial and industrial trouble was steadily disappearing into the background, because we were learning again that the sure road to a peaceful world was a strong Britain. If they looked at all the other indices, there was no reason why Britain should not continue to prosper. And yet business people continued to talk about things being difficult and trade being depressed. He suggested that the only real justification for pessimism to-day was the way in which they were getting strangled with red tape. Day by day he came across business schemes which were delayed, many of them abandoned, because of the impossibility of threading one's way through ever increasing official requirements. "If only the politicians would leave us alone, how much better we might be!"

Sir Ernest Benn continued:—"I am a believer in Free Trade. I prefer the term Freedom of Trade, but it seems to me that in these days of coalitions and compromises, there is room for a coalition between the Free Traders and the Protectionists. I can see a new cause with a new slogan which would read 'Back to Tariffs,' because I suggest to my Free Trade friends that there is very much more freedom to be won from quotas, barter arrangements, trade agreements, licences, exchange controls, export credits and all the other devices of the modern bureaucrat which clog the wheels of business. With a tariff, however stupid, you do at least know where you are."

Turning to the directors' report and accounts, Sir Ernest Benn said that the gross profit was £5,669 less than last year. That had been balanced to some extent by a reduction in general salaries and wages (including directors' remuneration) of £2,853. It had also been helped by the fact that their rents were £986 up, and their interest and dividends £381 up. Then there was £624 more to provide for income tax and National Defence Contribution. The growth of discounts by £822 reflected the tendency of their business to get more and more into the hands of the advertising agent.

As regards the balance sheet, their reserves were up in total, and now amounted to more than the whole of the ordinary shares of the business. Their investments were up by £15,000 and their cash down by £2,700. They had invested, in a matter of 10 years, £80,536 in the interesting publishing business, Ernest Benn, Limited. They had received back in cash £61,500 of that total. The subsidiary therefore stood as a net investment of £25,000, which was as safe as any item in their balance sheet. He would once again remind them that their assets were all good. There

was no doubt as to their marketability, more so than the City of Leeds 3½ per cent. loan which was raised a fortnight ago.

The Chairman ended by moving a resolution for the adoption of the report and accounts and for the payment of the following dividends: 3 per cent. on the Preference shares (making 6 per cent. for the year), 10 per cent. on the Ordinary shares (making 15 per cent. for the year), and 2s. per share on the Deferred share (making 3s. per share for the year).

Seconding the motion, Mr. Gordon Robbins said that Sir Ernest Benn, in his masterly survey, had again given the shareholders good measure. All would look forward to seeing Sir Ernest in the chair two years hence to celebrate the jubilee of his highly successful association with Benn Brothers, Limited.

The motion was carried unanimously.

Mr. C. E. Hughes and Mr. Norman French were re-elected directors of the company, and Messrs. Cassleton, Elliott and Co. were reappointed auditors to the company.

Mr. B. A. Glanvill, proposing a vote of thanks to the chairman, which was cordially endorsed, said that he did not know whether Sir Ernest Benn would ever become a sort of financial dictator, but he thought his services should be in some way utilised by the Government of the country.

Press Welcome to Sir Ernest Benn's New Book

Debt—the Coming Subject

PUBLIC interest in the dangers of the debt position is spreading rapidly since the publication of Sir Ernest Benn's latest book. Local authority finance is coming under much needed criticism all over the country. We reproduce extracts from a few of the reviews from the public Press.

The Times . . . his very lively and stimulating book. It is impossible to withhold agreement with him on his main conclusions.

Evening Standard. Sir Ernest Benn does good service in exposing the scandal of the Government's over-subscription notices in connection with debt issues. He shows conclusively that the public was misled into believing that the £100,000,000 2½ per cent. Funding Loan was over-subscribed.

Time and Tide. His book is a strikingly lucid statement of the place of credit in modern life. He is an uncompromising and principled individualist; Sir Ernest is right when he contends that public expenditure must, inevitably, be limited by the size of the national income.

Daily Independent. Sir Ernest Benn is always an interesting controversialist, and his new and alarming book on the growth of public and municipal debt in this country is deserving of study. The end of over-borrowing may be national disaster.

Daily Sketch. It requires a brave man in these hard times to write a book on debt. But, as it has been wisely said that every emergency produces heroes, the popular emergency of debt has produced as its hero Sir Ernest Benn. It may sound difficult to make debt a "popular" topic of discussion, but Sir Ernest has certainly succeeded in his recently published book, which rejoices in the simple and solemn title "debt."

Daily Mail. From parish councils, in which he makes no distinction between Socialists and "woolly-minded Conservatives," upwards, Sir Ernest sees the same process of reckless optimism and improvidence. Sir Ernest urges that Britain, "as guardians of the world for credit and all that appertains to finance," should cry halt to the further piling up of debts.

Financial Times . . . a courageous attempt to educate the public to the dangers of overborrowing. His criticisms are sometimes severe, but there was urgent need for such authoritative proclamation of the sound conclusions he draws.

Industrial Health and Safety

Increase of Accidents in 1937 shown by Report of Chief Inspector of Factories

THERE has once again been a notable increase in the number of accidents reported, states the annual report of the Chief Inspector of Factories and Workshops for 1937, though the increase is not so great as last year. The total number of such accidents was 192,539, of which 1,003 were fatal. These figures show an increase of approximately 9 per cent. respectively over the corresponding figures of 176,390 and 920 for 1936. In factories and workshops alone there were 176,013 accidents, including 716 fatalities. 124,878 men, 15,840 women and 35,295 young persons were injured and of these numbers 638 men, 16 women and 62 young persons were killed or died in consequence of injuries. The increase was spread over most of the country, there being a decrease in only a few districts.

Accidents Due to Carelessness

A factor of increasing importance in connection with the incidence of accidents in certain areas is the employment for the first time in factories of large numbers of unskilled or partly trained persons on processes or at machines of which they have little or no knowledge, in consequence of the shortage of skilled or semi-skilled labour. It is estimated that in Coventry, for instance, there are 10,000 more people employed than a year ago. Other factors which must be taken into consideration are the speeding up of operations and the longer hours worked in many factories.

Notwithstanding the continued efforts of inspectors to bring home to those concerned the extreme danger of approach to revolving shafting, the affixing of notices prohibiting the mounting of belts or other work which involves approach unless the shafting is stopped, and the exhibition of somewhat gruesome pictures illustrating the dire results of disobeying instructions, distressing accidents at shafting continue to happen, often with fatal results. It would seem that some workers still refuse to believe that shafting is dangerous, or perhaps it would be more correct to say that they think that they are too clever to be caught.

Hoists were responsible for 432 accidents, of which 29 were fatal, as compared with 490 accidents (20 fatal) in 1936. Most of the persons injured were either crushed between the cage and some projection in the well or fell down the well. Although the standard of hoist fencing has been rising every year, there still remains a large number of insecurely protected hoists. Section 22 of the new Factory Act will give a much needed impetus, and good progress to comply with the provision was being made during the closing months of the year. It is very improbable, however, that all the necessary alterations, replacements and reconstructions will be completed by the time the Act comes into force, so that the full benefits will not be felt for some time.

Fire and Explosion

Fire risks have been increased by the growing use of cellulose solutions and several fires have been caused through the removal of solid residues with steel tools, and in one case through ignition of the residue in the duct by friction from the blades of the fan. Static sparks appeared to be the cause of a number of fires in factories in which inflammable liquids were used. Two fires involving one fatality occurred in dry cleaning works during the rinsing of artificial silk garments with petrol in one instance and "washed benzene" in the other. Static sparks had often been seen before the outbreaks, particularly when artificial silk goods were being cleaned. The danger is increased when such low flash point liquids are used. A fatal case of phosgene poisoning occurred when a carbon tetrachloride fire extinguisher was used in a confined space. The liquid came into contact with hot metal and phosgene was evolved.

Although there may be differences of opinion as to the value of surprise alarms in connection with fire drill, the methods adopted by one firm to ensure that the alarm shall be unexpected, may be mentioned. A paper with the word "Fire" written on it is buried under a pile of skins and the person who first exposes it must give the alarm.

An explosion of carbon bisulphide vapour resulted in injuries to five men and considerable structural damage. Apparently the vapour accumulated (until an explosive mixture with air was formed) owing to the fan at the condensing plant being stopped, and the mixture was fired by an adjacent steam cylinder at a temperature of 100°C. The necessary steps have been taken to prevent a recurrence.

A number of accidents happened when tanks or drums which had contained petrol were being repaired by welding or soldering, and one man was fatally injured when the flame of the oxy-acetylene burner he was using to cut up an old chassis came in contact with the petrol tank. In consequence of this fatal accident some inquiry was made into the practice in scrap yards where old motor car bodies are broken up, and the ignorance displayed as to the danger from petrol tanks was surprising. Section 28 (4) of the new Factory Act should do much to dispel this ignorance. Several explosions were caused through the breaking of unsuitable inspection lamps while being used for the examination of the inside of vessels containing inflammable liquids.

An important change made by the new Act relates to certificates of fitness. The young worker will no longer be examined only to ascertain that he is not unfit to work for the full period allowed by law, but the examination will also be made with a view to determining the work for which he is suitable—he may be subject to re-examination and his school medical record will be available when required by the practitioner appointed to carry out the examination. The practitioner will be designated examining surgeon and no longer will be known as the certifying surgeon.

Lead and Mercurial Poisoning

The number of cases of lead poisoning notified is lower than in any year since notification for this disease came into force. It cannot be expected that the number of cases will continue to decrease each year, however much this is to be desired. The uses for lead are manifold and the ways in which lead poisoning may be contracted are numerous and unfortunately not always realised in time. At any time a new process may be introduced, the danger of which is not appreciated or a lead process may be greatly extended.

Two cases of mercurial poisoning occurred in the manufacture of thermometers and five in the manufacture of a seed dressing containing a mercurial preparation. In the five cases the workers were, in the early part of the process, exposed to methyl mercuric iodide, a volatile compound of mercury. The patients, aged from 16 to 57 years, and employed for periods varying from 4 to 21 months. Having in mind the effect of a volatile lead compound on the central nervous system and the occurrence of a group of cases of this character, it appeared reasonable to think that a volatile mercury compound might select the same site and produce this series of cases.

One case of manganese poisoning was reported in a man who had been employed for 11-12 years (13-14 years in all with a two-year interval) in the grinding and bagging of manganese ore. One of the ten notified cases of aniline poisoning was due to splashing of aniline oil when filling into drums; the remaining nine cases were due to nitrobenzene 1, artho-nitro-benzene 1, and di-nitro-benzene 7. Arseniuretted hydrogen was responsible for two cases of

toxic jaundice where the gas was evolved from acidified residues of cadmium.

The increase in the number of notified cases of chrome ulceration from 84 last year to 101 this year, is probably due, to some extent, to the fact that many certifying surgeons and appointed surgeons had their attention drawn to the importance of notifying a case as soon as a diagnosis is made and not delaying until the affected person has been off work for three days. The main increase, however, is in connection with industries other than where chrome products are manufactured or used in dyeing, tanning or plating, the principal one being chromating of metal by a special process which provided 32 cases, anodic oxidation providing 5, manufacture of colour and dyes 1, and printing and engraving 1.

A workman employed in a distillery descended a ladder into a vat in which hot liquor was fermenting to retrieve a thermometer which had fallen into the vat, although warning notices were displayed in prominent places emphasising the danger of entering vats before testing for gas. The foreman went to his rescue and both lost their lives. Since these fatalities this factory, and five associated factories in other districts, now provide two sets of breathing apparatus, a provision that would appear desirable in every distillery where such accidents may occur.

A fatal case of nitrous fumes was the result of the cracking of an oil-heated metal bath containing sodium nitrate used in the treatment of metals. Similar cases have been reported from other countries. An attempt has been made to find another salt which, should a similar accident to the bath occur, would not liberate these injurious fumes.

A man painting the inside of a 1,300 gallon brewery tank with an enamel containing trichlorethylene and carbon tetrachloride was overcome. In this case an "Antipoys" breathing apparatus was in use, but apparently it had not been properly adjusted or the outlet valve was not functioning as such. This illustrates well the importance not only of having available a suitable breathing apparatus, but also of training men in the testing and correct use of such apparatus. Trichlorethylene is apparently still regarded in some quarters as harmless, and users of this solvent have at times been misled in this respect.

During the process of a special treatment of certain oils involving the use of maleic anhydride, contact with the fume escaping in the atmosphere or with the liquefied product splashed on the clothing or skin was found to be capable of causing a painful conjunctivitis and some temporary irritation of the upper respiratory tract with cough, in addition to vesicular dermatitis of the skin, especially if abraded. Eight men were affected in varying degrees and in three cases incapacity for periods varying from 9 to 40 days resulted. The use of a one per cent. solution of sodium bicarbonate for an eye wash or gargle, or of 10 per cent. strength for application to the skin, was found to be of value in treatment. Leakage of ethyl nitrate from a still caused loss of consciousness for 20 minutes. One man who, for six weeks, had supervised the filtering of a mixture containing ethylene dichloride on an experimental plant, suffered from dizziness, nausea with slight vomiting, severe headache and an itchy urticarial rash with swelling of the skin lasting for ten days.

INDIAN CHEMICAL MANUFACTURERS' ASSOCIATION

AN Indian Chemical Manufacturers' Association has just been established in order to protect and promote the interests of the chemical, pharmaceutical and allied industries. The Association considers that the recent growth of the chemical industry in India has raised a number of questions which require concerted action on behalf of all engaged in it. Sir P. C. Ray has been elected president of the Association, and a representative of each of the various chemical manufacturing concerns in India constitute the members of the committee.

Accelerated Vulcanisation

A Study of Arsenic Compounds

A STUDY of the acceleration of the vulcanisation process by arsenic compounds has been carried out by van Rossem and Bouwens (*Rec. Trav. Chim.*, 1938, 57, 798-805). Vulcanisations of rubber in the presence of 8 per cent. of sulphur, and varying quantities of arsenic compounds such as the tri- and pentoxide, and the tri- and pentasulphide, with and without additions of diphenyl guanidine and zinc oxide, were performed.

It was found that the trisulphide and trioxide were most effective in reduction of curing time, the pentavalent compounds and the disulphide (As_2S_2) being next in order of efficiency. Finely divided arsenic itself and an organic arsenical such as sodium cacodylate were about half as good as the trioxide and trisulphide, but even so caused a considerable reduction in curing time. The tensile strength of the product was only slightly less than that of the control sample. The maximum effect was obtained with quantities as small as 0.05 per cent. addition of 0.5 per cent. As_2O_3 gave no greater acceleration than 0.05 per cent.

In the presence of diphenyl guanidine (D.P.G.) the acceleration effect of arsenic compounds was not so marked, and when zinc oxide was added there was no reduction of time of cure, and the mechanical properties of the product were bad unless D.P.G. was present.

Examination of the products vulcanised showed that in all cases there were bright yellow spots when arsenic trioxide were present. These were usually hollow in the middle and were composed of arsenic trisulphide. This cannot have been produced by the reaction of As_2O_3 and S, since the temperature was too low, and was probably the result of reaction with some organic sulphur compound in the rubber, with the production of As_2S_3 and water which would collect in the hollow centre.

The removal of the non-rubber constituents of latex with acetone or by other means did not affect the accelerating power of arsenic compounds, which seems to rule out any possibility that this power is dependent on the formation of arsenical thio compounds with the proteins in natural rubber, in the same way that organic arsenicals have been shown to act therapeutically. This, however, is not conclusive since it is impossible to remove all protein matter from rubber and the quantity of arsenic required is so small.

An X-Ray Study of Refractories

The Influence of Crystal Size

THE results of a study of refractories by means of the X-ray camera are summarised by Jay and Chesters (*Trans. Ceram. Soc.*, 1938, 37, 209-230). The size of the individual crystals in quartzites was found to vary widely, not only from one sample to another, but also within a given sample. Firing at 1,450° C. for 1 hour produced varying amounts of cristobalite and tridymite, the amount increasing with the fineness of the crystals and the amount of impurity present; iron oxide, in particular, is very active.

Silica bricks taken from the first zone of an open-hearth furnace contained considerable amounts of cristobalite, whereas those from the second zone showed a preponderance of tridymite. The particle size of the converted material was about 0.01 cm., compared with an average of 0.001 cm. for the quartz in the bricks before firing. Examination of magnesite bricks of high thermal shock resistance showed that coarse crystallinity is not an essential for this property. Bricks having fine crystals were just as satisfactory, though they may deteriorate through recrystallisation.

Chrome ores from different sources gave different and very characteristic X-ray patterns, so characteristic that it was possible to identify the source of the ore from which the chromite in chromemagnesite bricks had been prepared.

Modifications of Lac with Higher Fatty Acids* Their Mixed Glycerol Esters

By R. BHATTACHARYA, Ph.D., F.I.C., and B. S. GIDVANI, Ph.D., A.I.C.

IN a previous publication (Technical Paper No. 12, London Shellac Research Bureau) the possibilities of modifying lac with fatty acids and glycerol were indicated. The nature of the chemical reactions involved has been described in a recent paper (*J.S.C.I.*, 1938, in the press) in which a tentative formula of the product obtained by heating lac with fatty acids and glycerol or mono-glycerides has been suggested. At least four distinct reactions appear to take place under the conditions of experiments. (1) Esterification of fatty acids and glycerol, primarily to the mono- and di-glyceride stage; (2) reaction between hydroxyl groups of lac and mono-glyceride or glycerol; (3) esterification of mono- and di-glycerides with fatty acids; and (4) esterification of the carboxyl group of lac with mono-glyceride. There is some evidence to show that fatty acids can also esterify with hydroxyl groups of lac. But in presence of glycerol this reaction may not take place as fatty acids will probably esterify preferentially with glycerol.

As several simultaneous reactions are involved, it is difficult to correlate satisfactorily the observations on the rate of reaction. Nevertheless, the progress as well as the nature of reactions can be followed by the acid and hydroxyl values of the products at the various stages of reaction. These data also show the influence of temperature and the catalyst. It has been found that the activity of the catalyst has a marked influence on the reaction. The concentration of catalysts of the same activity has very little effect, though the temperature, as can naturally be expected, plays an important part. Between 120°-140° C. the activity of aromatic sulphonic acids is greater than that of aluminium sulphate, while at a fairly high temperature (180°-200° C.) the catalyst can be dispensed with altogether. The presence of strong catalysts promotes gelation, this being partly due to the polymerisation of lac and partly to the gelation of the unsaturated fatty acids.

The results obtained indicate that if drying oil fatty acids are used, a range of products can be obtained by varying the proportions of components, which are suitable as varnish materials and can be compared with oil-modified alkyd resins. Reference should be made to a recent patent (B.P. 468,542) in which lac, fatty acids, glycerol and phthalic anhydride have been used to produce suitable varnishes. For a number of uses, addition of phthalic anhydride is considered advantageous. Even without phthalic anhydride, the products are suitable as general coating compositions in the paint and varnish industry; particularly for baking varnishes, addition of phthalic anhydride does not seem to be necessary. The varnishes made by the methods described in this paper dry quickly, possess good gloss and bake extremely well.

Lac Oil Varnishes

During these experiments it was found that fatty acids were first forming mono- and di-glycerides which were reacting with lac. As the mono-glycerides of fatty acids are available commercially, lac oil varnish can be made either by heating together lac and mono-glycerides of drying oils or fatty acids, glycerol and lac.

As the acid value of varnish media is an important factor in their application, particularly in grinding basic pigments, the lowering of acid values with the time of heating under suitable conditions has been studied in detail. For practical purposes, in making lac oil varnishes using lac, fatty acids and glycerol, it will be adequate to continue the heating until the acid value of the product corresponds to the residual acidity of lac present in the mixture. Thus for a 50:50 lac oil varnish, the heating should be continued until the acid

value of about 35 is obtained. This acidity is then reduced by the addition of lime or other suitable bases. It has been found in the case of mono-glycerides that products having an acid value of about 10 without the addition of bases can be obtained by adding the requisite amount of mono-glycerides in two or three lots during the heating. If the necessary quantity of mono-glycerides is taken in one lot, gelation sets in on prolonged heating, before the desired acid value is reached. In a long oil varnish the presence of excess of free mono-glycerides will delay or inhibit the air drying of the film. In order to obtain tack-free films in such cases it is necessary to add a small amount of fatty acids during the "cooking." The mono-glycerides are thus converted into di- and tri-glycerides which give tack-free films on air drying.

The colour of the varnish is another important consideration. If a dark colour can be tolerated, ordinary shellac can be used, but for a pale and clear varnish, suitable for grinding white pigments, better qualities of decolorised lacs must be used.

Influence of Temperature and Catalyst

To study the effect of catalysts and temperature, definite quantities of lac and linseed oil fatty acids were first mixed at 120° C. with stirring and 10 per cent. of glycerol on the total weight of the lac and fatty acids was added. The addition of catalysts followed, and the stirring continued. In one experiment the temperature was maintained at 120° C., and in the other at 140° C. Samples were removed at regular intervals, and the acid value of each sample determined.

It was observed that the acid value drops rapidly at first, and then decreases rather slowly till a state of equilibrium is reached. The reaction is faster at the higher temperature and in the presence of *p*-toluene sulphonic acid which is more active than the other catalyst used, aluminium sulphate. Moreover, in the presence of a comparatively large amount of lac, gelation takes place on prolonged heating.

In a recent publication (*J.S.C.I.*, 1938, in the press) it has been pointed out that in the case of lac, linseed oil fatty acids and glycerol, the first stage of reaction was the esterification of linseed oil fatty acids with glycerol to a mixture of mono- and di-glycerides and simultaneous etherification of the mono-glycerides with the hydroxyl groups of lac. As the esterification of linseed oil fatty acids with glycerol proceeds very rapidly, attempts were made to reduce the time of reaction for a definite acid value of the product, by adding lac to partially esterified fatty acids. For this purpose, lac was added after fifteen minutes' reaction of glycerol with fatty acids in the presence of *p*-toluene sulphonic acid, and one hour's reaction with aluminium sulphate as catalyst. As the reaction with *p*-toluene sulphonic acid as catalyst was very rapid, it was found that lac could not be dispersed if the initial esterification of the fatty acids was allowed to proceed longer than fifteen minutes. A study of hydroxyl values of the esterification products of linseed oil fatty acids with glycerol at various stages, revealed that after fifteen minutes' reaction in the presence of *p*-toluene sulphonic acid the mixture contained 25 per cent. mono- and 75 per cent. di-glycerides, while after one hour's reaction the product represented 84 per cent. di- and 16 per cent. tri-glycerides. It was, therefore, apparent that at least 25 per cent. mono-glycerides are required to disperse lac in the mixture of the glycerides.

It was seen from partial esterification of linseed oil fatty acids with glycerol and then condensation with shellac that the acid value of the product by the partial esterification process decreases more rapidly, particularly in the first few hours. While heating could be continued for over ten hours

* From Technical Paper No. 14, London Shellac Research Bureau.

in the case of the simultaneous reaction, using aluminium sulphate as catalyst, the product polymerised in five hours, if the linseed oil fatty acids were first esterified with glycerol and then reacted with lac.

Next, attempts were made to allow lac to react with glycerol first and then adding the fatty acids. It was observed that there was a slight drop in the acid value in 15 minutes when the mixture showed signs of gelation. The fatty acids were then added and heating continued. The lowering of acid value was very slow and gelation took place quicker.

Reaction between Lac and Mono-Glycerides

It was observed that to obtain products with definite acid values the time of heating was considerably reduced if the fatty acids were first partially esterified with glycerol and then allowed to react with lac. It followed, therefore, that by using mono-glycerides instead of fatty acids and glycerol, further economy in time and heating could be achieved.

In the paper in which the theory of the reaction involved between lac and mono-glycerides has been discussed, it has been suggested that one molecule of lac combines chemically by ether linkages with two molecules of mono-glycerides. Any excess of uncombined mono-glycerides remains freely dispersed in the mass. If the approximate molecular weight of lac is taken as 1,000 and that of mono-glycerides as 350, it is evident that 100 parts by weight of lac could combine only with 70 parts by weight of mono-glycerides. Mono-glycerides of unsaturated acids are liquids and do not lend themselves to polymerisation by air drying or short baking. A film containing such a material will naturally be tacky. In the 50:50 by weight product, there is a large proportion of free mono-glyceride (15 parts). The drying properties of such a material could be greatly improved by adding a relatively small amount of fatty acids during heating, as the fatty acids would convert the mono-glycerides into di- and tri-glycerides, which would dry in the usual manner, giving non-tacky films. It has been found that if the proportions of lac to mono-glycerides is maintained within the limit of 10 parts by weight of lac to 7 of mono-glycerides, the varnish obtained gives tack-free films on air drying.

To illustrate the ease of conversion of mono-glycerides to di- and tri-glycerides, the former were heated with fatty acids at 140° C. with a catalyst and the product analysed for hydroxyl values to show the composition.

Next, 50:50 lac-linseed mono-glyceride varnish was made in the usual manner by heating at 140° C. with the catalyst for 30 minutes and then 5 parts of fatty acids were added and heating continued for another 10 minutes. It was found that the resulting material had an acid value of 38.5 and gave films which were non-tacky on air drying.

In another experiment 50 gms. mono-glyceride were mixed with 5 gms. of fatty acids and the mixture heated with 50 gms. of lac at 140° C. with a catalyst. After heating for 30 minutes, the product had an acid value of 39, and gave tack-free films on air drying.

Reaction at High Temperatures

The reaction at high temperatures without catalyst was then studied. For this purpose lac was added gradually to fatty acids at a temperature of 140-150° C., with stirring. After all the lac had been added, the temperature was gradually raised to 180° C., when a clear bead resulted. Glycerol (10 per cent. on total weight) was then added and the heating continued for several hours. The reaction progressed smoothly as in the lower temperature experiments in the presence of catalysts. Similar results were also obtained when lac was allowed to react with mono-glycerides at 180-200° C. without catalysts.

So far, all the processes which have been described give a product in which the acidic part of the lac molecule has not been attacked by either glycerol or mono-glycerides, and the acid value of the material is due to this residual acidity of lac. It has been pointed out elsewhere (*J.S.C.I.*, 1938, in the

press) that the reaction involved is that of "etherification" between hydroxyl groups of lac and those of either glycerol or mono-glycerides, with the elimination of water. It is, however, possible to esterify the carboxylic group of lac with glycerol or mono-glycerides under suitable conditions. In such a case a neutral product can be obtained and actually it has been possible to reduce the acid value to 8-10. To achieve this end, gelation of the drying oil mono-glycerides through their double bonds as well as the polymerisation of lac must be prevented and experimentally these conditions are obtained by adding the mono-glycerides, not all at once, but in small lots during cooking. In one experiment, 100 gms. of lac were heated with 70 gms. mono-glycerides at 180° C. for 20 minutes, when a clear bead was obtained. Heating was continued for another 20 minutes and 20 gms. more of mono-glycerides were added. After another 15 minutes heating, 15 gms. more mono-glycerides were added. The acid value of the product after 20 minutes heating was 8. In such a reaction, one molecule of lac reacts with three of mono-glycerides or 100 parts by weight of lac to 105 of mono-glycerides. Films made from such a product are non-tacky and hard. If, however, the proportion of mono-glycerides is more than that stated above, tacky films are obtained. (This tackiness has already been discussed.

Properties of Products and their Films

In Technical Paper No. 12 it has been stated that the nature and type of the fatty acids, as well as their relative proportions, will influence the properties of these products. These products may be looked upon as either oil modified synthetic resins, or resins-incorporated oils. Though the experiments described in detail have been mainly limited to the linseed oil fatty acids and their mono-glycerides, other fatty acids and mono-glycerides such as castor oil fatty acids, stearic acid, etc., have been used in some cases. Any type of lac can be used, though the experiments described in this paper have been confined only to dewaxed lemon shellac. This gives a dark coloured product, but a very pale product can be made by using mono-glycerides or pale fatty acids with bleached or decolorised lac.

While products containing moderate proportions of fatty acids or glycerides could be dispersed in hydrocarbon thinners (paraffin or coal tar), products containing fairly large proportions of lac require alcohol or a mixture of alcohol and hydrocarbon for thinning.

The compositions, methods of preparation, and acid values of a number of products, as well as the general behaviour of their respective films after thinning, were determined. The acid value of varnishes containing large proportions of lac is higher than those with smaller proportions. As has already been explained, this residual acid value is chiefly due to unesterified carboxylic groups of lac. This acid value can be reduced further, either by careful heating for a longer period or by addition of lime and other bases. Half to one per cent. of slaked lime dispersed in the varnish before thinning will not only reduce the acid value to about 20 or less, but also impart hardness and improved drying properties to the films. Addition of lime will also reduce the living tendency of basic pigments when ground in such media. For a brushing consistency, the thinning ratio is approximately 1 part of solid to 1.3-1.5 parts thinner.

Generally speaking these varnishes possess excellent gloss and are suitable for air drying and baking finishes. Though unpigmented films show signs of checking and cracking, on exposure outside, with small quantities of tung-oil or when pigmented, the paint films have stood natural weathering for 18 months before any appreciable chalking could be detected.

The products made from mono-glycerides, and those with acid values higher than 40, can be dispersed in dilute ammonia and possess emulsifying properties. Particularly with polymerised castor oil mono-glycerides, lac gives a material which could emulsify even nitrocellulose.

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Personal Notes

THE LATE MR. JOHN STANLEY PHILLIPS, of Windsor, managing director of Sutton and Phillips, analytical chemists, of Stowmarket, left £38,358, with net personalty £34,029.

THE LATE DR. WILLIAM HENRY BONE, of St. Albans, professor of chemical technology at the Imperial College of Science and Technology, University of London, left £43,400, with net personalty £41,661.

MR. J. PHILIP ASQUITH, B.Sc., has been awarded one of the Leverhulme scholarships in chemical engineering valued at £250. Mr. Asquith is a native of Sunderland. Since taking his degree last year, he has been on the research staff of a works at Derby.

MR. ARTHUR REGINALD HENRY TRIM, B.A., of Trinity College, has been appointed by the managers of the Benn W. Levy Fund to the research studentship in biochemistry for the period from July 1 to June 30. The value of the studentship is £100 a year.

The late MR. ROBERT WILLIAM HUDSON, of Monaco, a former High Sheriff of Buckinghamshire, and at one time head of R. S. Hudson, makers of Hudson's dry soap, left personal estate in England of the value of £234,146, on which duty of £70,480 has been paid.

MR. NORMAN FRENCH, a director of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, sailed from Southampton yesterday—Friday—in the *Empress of Australia* on a visit to Canada, and will be away about five weeks. Mr. French, who is the editor of *The Timber Trades Journal*, is going out by direct invitation of the Government of British Columbia.

MR. J. E. JAMES, chairman and managing director of the Lancashire Steel Corporation, COL. SIR W. CHARLES WRIGHT, chairman of Baldwins, and MR. S. R. BEALE, chairman and managing director of Guest, Keen and Nettlefolds, and a director of John Lysaght, have been confirmed in their election to the board of Richard Thomas and Co., appointed under the recent scheme. MR. JOHN ADAMSON, chartered accountant, a partner of McClelland, Ker and Co., has joined the board.

OBITUARY

PROFESSOR NICOLA PARRAVANO, well-known Italian chemist, who has occupied the chair of general chemistry at Rome University since 1919 and was a member of the Italian Academy, has died in Rome, aged 55.

Foreign Chemical Notes

Russia

KRYPTON-XENON MIXTURE at the rate of 1 to 1½ litres per day is now produced at the Moscow Electrotechnics Institute.

Poland

ERGOT PRODUCTION ON AN INCREASED SCALE is being organised as the export prospects are now favourable.

Sweden

THE I.G. FARBENINDUSTRIE HAS GRANTED SOLE LICENSE FOR THE MANUFACTURE of carbon bisulphide in Sweden to the Elektrokemiska A/B of Bohus.

France

A SPRING WITH A HIGH HELIUM CONTENT in its water has been discovered at Arnay-le-Duc in the Côte-d'Or Department. A potential annual output of 55 hectolitres of helium is considered possible.

Czechoslovakia

ABOUT 1,000 HECTARES OF LAND are now under cultivation with soya bean, yielding an annual harvest of 900 tons which is mainly used for edible purposes. More extensive cultivation with a view to industrial exploitation of the bean is now being planned.

New Technical Books

DER ULTRASCHALL UND SEINE ANWENDUNG IN WISSENSCHAFT UND TECHNIK. (Ultra-sonics and its application in science and technique). Berlin: VDI Verlag GMBH.

Very seldom has a discovery found so many applications in the short time of a few years in nearly all field of science as the technique of ultra-sonic waves. During the last few years more than 450 different papers were published in many languages, and the author has filled a gap by collecting all these papers in a small but excellent book on the scientific application of ultra-sonic waves.

NOTES ON QUALITATIVE ORGANIC ANALYSIS. By F. R. Storrie. Pp. 68. London: J. M. Dent and Son, Ltd. 2s. 3d.

This moderately priced book will give the student an account of the principles of qualitative organic analysis without being so extensive as to lead to his confusion. The compounds described are only those which the student is likely to meet in his practical work. Emphasis has been laid on the necessity of finding the group or class to which a compound belongs before attempting to determine its individuality. The reactions used in ascertaining the group or class have been limited in number; specific reactions have been used sparingly. Judicious selections of suitable derivatives have been suggested for each group. Specimen reports of analyses have been included. Reference is made in the text to the source of some of the methods described.

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA. Pp. 1,234. London: Chapman and Hall, Ltd. 50s.

This encyclopedia covers the basic sciences of chemistry, physics, mineralogy, geology, botany, astronomy and mathematics; the applied sciences of navigation, aeronautics and medicine; and three branches of engineering—civil, mechanical and electrical. The responsibility for each science has been left largely in the hands of a single author, in order to gain a unity which is impossible when many contribute. Nevertheless, in each field a number of contributors have worked with the author, and a still larger group have been consulted in an advisory capacity. Over ten thousand terms of scientific interest are arranged alphabetically, and an extensive system of cross-indexing has been developed to enable the reader to find all of the facts that bear directly on each included topic. Limits have necessarily restricted the length of the article and the size of the illustration. A feature is the progressive development of the discussion of each topic, beginning with a simple definition said to be expressed in the "plainest terms" (but in many instances far too scientific to be "readable"), thence progressing to more detailed scientific aspects of the topic (which do prove to be very useful to the inquiring layman as well as the trained technician).

Ten Years Back

From "The Chemical Age," August 11, 1928

MR. Rudolph Muspratt, son of Sir Max Muspratt, was on Wednesday, August 1, admitted a Liveryman of the Worshipful Company of Dyers, thereby becoming a Freeman of the City of London.

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At the Parliamentary By-election held recently in the Hallam Division of Sheffield, Mr. Louis W. Smith, chairman of Doughty-Richardson Fertilisers, Ltd., of Lincoln, was returned as Member of Parliament (Conservative).

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Hitherto, the work of observation of pollution has been carried out by the Meteorological Office (Air Ministry) Advisory Committee on Atmospheric Pollution. A reorganisation has now taken place, and the work will in future be carried out by a body representing jointly the Department of Scientific and Industrial Research and local and other bodies who maintain gauges and keep records.

From Week to Week

JAPANESE RAYON recently placed in bond because it was said to be wrongly classified by the Customs authorities as staple fibre has now been released on payment of the original duty.

PROPOSALS ARE TO BE PUT to the Government by Lancashire and Cheshire Miners' Federation for the setting up on the south-west side of the Lancashire coal field of plant for the extraction of oil from coal.

PHENOL, LTD., have taken a reconditioned building on the site of Beardmore's former shipyard at Dalmuir and are installing plant to distill tar, oil and other chemical products from oil cargoes which will be landed at an adjoining wharf.

THE LARGE CHEMICAL WORKS now in course of erection for Imperial Chemical Industries, Ltd., at Mossend, Lanarkshire, will have taken definite shape to permit of production commencing early in 1939. A large cooling tower is now being erected.

AT THE WORLD POWER CONFERENCE sectional meeting to be held at Vienna, August 25-September 2, Sir Harold Hartley, F.R.S., chairman of the Fuel Research Board, will act as an official representative of the Government of the United Kingdom.

CONTRIBUTIONS TO THE APPEAL FUND (Fifth List) of the Birmingham Hospitals Centre include, Albright and Wilson, Ltd., Oldbury, £2,340 (total); Southalls (Birmingham), Ltd., £2,000 (total); Mr. Wilfred Hill, County Chemical Co., Ltd., £5,000; H. P. Sauce, Ltd., £1,250; Midland Tar Distillers, Ltd., £73 10s. (total).

FIRE BROKE OUT at Donald Macpherson and Co., Ltd.'s paint and varnish works, Manchester, on August 3, and did damage estimated at £10,000. Within an hour the whole of the paint factory was in flames and beyond any possibility of being saved in spite of the quick arrival of the Manchester Fire Brigade in full force.

THE CLYDE ALLOY STEEL CO., LTD., have constructed one of the most up-to-date laboratories in Lanarkshire at their Netherton Works, Motherwell. Built almost entirely of ferro-concrete, the laboratory is equipped with the latest developments for the testing of steel and for research work. One section of the building is devoted to experimental heat treatment.

THE MINISTER OF LABOUR announces his intention of establishing a trade board covering the whole of the rubber manufacturing industry. He reached this decision in consequence of a request from firms in the trade, supported by the unions concerned, which was also approved by the employers. An investigation carried out by the Ministry of Labour had shown that the rates of wages paid to a large proportion of the rubber workers made a trade board desirable for the industry.

THE 37TH AUTUMN FAIR will be held in Prague from September 2 to 11. The capacity and the high standard of the Czechoslovak export production will be shown by 3,000 exhibitors coming again to the Fair. The bulk of the exhibitors is formed by glassware, porcelain, toys and leather goods manufacturers. Buyers travelling to the Prague Fair will be granted a 50 per cent. fare reduction in Czechoslovakia, and considerable facilities on other European railway, shipping, and air-lines.

RECOMMENDATIONS HAVE BEEN MADE to Salisbury Council concerning that city's water supply. Approved methods of treatment will consist at two sources of supply, of chlorination and chloramination respectively, Wallace and Tierman Diaphragm Chlorinators being utilised for a normal dosage of approximately 0.2 parts per million. Ammonia will be administered at pump sections and chlorine injected in delivery mains via accessory pumps, the dosages being 0.05 and 0.15 ammonia and chlorine per million respectively.

THE FIRE WHICH BROKE OUT recently at the Tupungato oilfield has now been extinguished, and the new borings have been sealed temporarily pending the preparation of storage facilities adequate to deal with the unexpectedly heavy flow which they have yielded. The Tupungato oilfield is in the province of Mendoza in western Argentina and is proving to be one of the richest in the country. Total production of crude oil in Argentina attained a new high record of 18,289,000 barrels in 1937, an increase of 5.5 per cent. over the 1936 output.

BORING FOR OIL IN NEW ZEALAND will commence shortly. If the enterprise is successful, Empire resources, will be enriched by a substantial petroleum supply. Resulting from reports of expert geologists who state that the criteria essential to the existence of oil are to be found in New Zealand, the Dominion Government has granted powers to a specially-formed company to conduct prospecting operations. An expert field-drilling staff, transferred from the Persian Gulf oilfields, and heavy modern drilling gear capable of reaching a depth of 10,000 ft., have arrived in the Dominion. The first well will be drilled in the Poverty Bay district, North Island, where oil seepages have been frequently located.

PLYMOUTH CORPORATION INVITES TENDERS for the supply, delivery and fixing of laboratory fittings, etc., for one central school, two senior schools and one junior technical school. Details are available from the city architect. Tenders have to be received by the Town Clerk by September 2.

GEORGE H. ALEXANDER MACHINERY LTD. are holding a machine tool demonstration at their Glasgow showroom on August 15-27. The demonstration will include the Deckel Universal miller, Deckel die-sinking machine, Deckel engraver, Radiac cut-off machine, Doull contour machines, Raboma radial drilling machine, Rockwell hardness tester and Erichsen pattern tester.

LARGE-SCALE EXTENSIONS to the Banbury works of the Northern Aluminium Co., are in progress, and, when completed, will approximately double the works' present manufacturing capacity of aluminium and special aluminium alloys in semi-finished form. New plant being installed includes a 5,000-ton extrusion press.

THE TRUSTEES OF THE LEVERHULME TRUST have invited four members of Parliament to conduct an inquiry in West Africa. Technical experts, whose services will be utilised, include Mr. E. M. Crowther, head of chemistry department, Rothamsted Experimental Station, Harpenden. The commission proposes to leave for Dakar, in French Senegal, on October 5.

TWO FIRE BRIGADES WERE NEEDED to prevent flames reaching magazines filled with high explosives when fire broke out at the factory owned by Explosives and Chemical Products, Ltd., at Harwich, on August 9. Two workrooms and part of a boiler house were damaged before the flames were put out. The factory is on a lonely marsh at Bramble Island, near Great Oakley. Five people were killed in an explosion at these works in 1928.

SOME £50,000 A YEAR, in the form of grants from the Department of Scientific and Industrial Research for the establishment of research associations for individual industries, remains unclaimed. Such grants are made by the Government pro rata to the amount that the industry concerned undertakes to subscribe. Already well over £1,000,000 has been contributed by the State for the purpose. The expenditure of this sum has attracted from the industries nearly £2,000,000.

OVERCOME BY CARBON MONOXIDE in a tank at the leather tannery of Nicholson, Sons and Daniells, Ltd., five men died at Little Irchester, on August 9. They were W. J. Smart, G. J. Smart, A. C. Sharpe, A. H. Gayton and S. G. Clow. Sharpe and W. J. Smart were cleaning out the tank, which is the overflow from a leather currying pit, when they collapsed. The others went to the rescue, but were overcome. Police-sergt. A. E. Faran, wearing a special gas mask, recovered the bodies after nearly half an hour's work in the tank.

DIPHENYL FAST YELLOW RL, a new product of the Geigy Colour Co., is a fast to light direct colour possessing a very pleasing clear gold shade. This can be used as a self colour alone or more frequently as a yellowing element in the production of a variety of fashion shades on cotton, cellulose rayons and mixed fabrics containing these fibres. On account of its good dischargeability it shows the marked advantage against other yellows frequently used for this purpose that dyes which are faulty for any reason can be readily stripped with hydro-sulphite.

IN THE VACATION COURT, High Court of Justice, on Wednesday, Mr. Justice Morton granted an *ex parte* injunction to Lanalol, Ltd., over Wednesday next restraining Mr. Gordon Oliver from offering for sale under the style Lanilol, or in any way calculated to lead to confusion, an ointment for use on scalps. Plaintiffs registered their trade mark in 1933 and they complained that since 1938 Lanilol had been offered for sale as ointment for sores and ulcers, including those of the head. His lordship said a *prima facie* case of confusion had been made out and he granted an *ex parte* injunction, with leave to serve notice of motion with the writ for Wednesday next.

New Companies Registered

Harold Moore & Partners (Engineers), Ltd. 342,993.—Private company. Capital £25,000 in £1 shares. To carry on business as oil refining and oil storage designers and engineers, fuel engineers and experts, chemical, mechanical, electrical, constructional, civil and consulting engineers, etc. Directors: Frank Wheatcroft, 6 Brown Street, Manchester; Albert E. Metcalfe. Registered office: Adelaide House, King William Street, E.C.4.

Alpha Cement, Ltd., have declared an interim dividend on the ordinary shares of 5 per cent., less tax, payable August 31, to shareholders registered as at that date. This dividend is the same as last year but is payable on 1,100,000 £1 ordinary shares, compared with 1,000,000 shares. A final payment of 7 per cent. on the larger capital brought the year's total to 13 per cent.

Weekly Prices of British Chemical Products

THE demand for industrial chemicals has been somewhat restricted during the past week and a holiday atmosphere has been in evidence. The market taken as a whole is not without interest and a fair volume of enquiry is reported for products normally in regular call although the quantities involved are by no means substantial. There are no important price changes to record for general chemicals and quotations continue at recent levels and on a steady to firm basis. In the coal tar section conditions remain inactive with little fresh business in circulation. Price quotations continue on a nominal basis although values are rather more steady than of late. An improvement in the position by the autumn is confidently expected in some quarters.

MANCHESTER.—Conditions have been a little more active on

the Manchester chemical market during the past week after the recent seasonal slackness. Deliveries against contracts have been on a fair scale and in some directions it is reported that the takings of the textile dyeing and finishing trades have been slightly better than of late. New business since last report, however, has been no more than moderate, with transactions confined to near delivery positions. Chemical prices as a whole remain on a steady basis. With regard to the by-products there has been a certain amount of enquiry about in one or two sections but business has been relatively quiet.

GLASGOW.—There has been a slight improvement in the demand for chemicals for home trade during the week, but export business still remains very limited. Prices generally continue quite steady.

Price Changes

Falls: Carbolic Acid, crude 60's; Pitch (Manchester); Pyridine, 90/140 per cent.; 90/100 per cent.

General Chemicals

ACETONE.—£45 to £47 per ton.

ACETIC ACID.—Tech., 80%, £30 5s. per ton; pure 80%, £32 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 2s. 6d. per ton d/d Lancs. GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders. SCOTLAND: 10½d. to 1s. 0½d., containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—Grey, £18 10s. per ton, d/d U.K. Fine white, 98%, £17 per ton, d/d U.K.

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammianic.)

AMMONIUM DICHROMATE.—8½d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11 per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. MANCHESTER: White powdered Cornish, £16 10s. per ton, ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £11 10s. per ton.

BLEACHING POWDER.—Spot, 35/37%, £9 5s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CHARCOAL, LUMP.—£6 to £6 10s. per ton, ex wharf. Granulated, £7 to £9 per ton according to grade and locality.

CHLORINE, LIQUID.—£18 15s. per ton, seller's tank wagons, carriage paid to buyer's sidings; £19 5s. per ton, d/d in 16/17 cwt. drums (3-drum lots); £19 10s. per ton d/d in 10-cwt. drums (4-drum lots); 3½d. per lb. d/d station in 70-lb. cylinders (1-ton lots).

CHROMETAN.—Crystals, 2½d. per lb.; liquor, £13 per ton d/d station in drums. GLASGOW: 70/75% solid, £5 15s. per ton net ex store.

CHROMIC ACID.—10d. per lb., less 2½%; d/d U.K.

CHROMIC OXIDE.—11d. per lb.; d/d U.K.

CITRIC ACID.—1s. 0½d. per lb. MANCHESTER: 1s. 0½d. SCOTLAND: B.P. crystals, 1s. 0½d. per lb.; less 5%, ex store.

COPPER SULPHATE.—£18 5s. per ton, less 2% in casks. MANCHESTER: £18 10s. per ton f.o.b. SCOTLAND: £18 15s. per ton, less 5%, Liverpool, in casks.

CREAM OF TARTAR.—100%, 92s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£20-£22 per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £4 2s. 6d. to £5 2s. 6d. per cwt. according to quantity; in drums, £3 15s. 0d. to £4 7s. 6d.

HYDROCHLORIC ACID.—Spot, 5s. 6d. to 8s. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 9d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots). Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One-ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. GLASGOW: White crystals, £30; brown, £1 per ton less. MANCHESTER: White, £30 10s.; brown, £30.

LEAD, NITRATE.—£32 per ton for 1-ton lots.

LEAD, RED.—£30 15s. 0d. to 1 ton, less 2½% carriage paid. SCOTLAND: £30 per ton, less 2½% carriage paid for 2-ton lots.

LITHARGE.—SCOTLAND: Ground, £30 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store. MAGNESIUM CHLORIDE.—SCOTLAND: £7 5s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 10d. per lb.; powder B.P., 6s. 0d.; bichloride B.P. (corros. sub.) 5s. 1d.; powder B.P. 4s. 9d.; chloride B.P. (calomel), 5s. 10d.; red oxide cryst. (red precip.), 6s. 11d.; levig. 6s. 5d.; yellow oxide B.P. 6s. 3d.; persulphate white B.P.C., 6s. 0d.; sulphide black (hyd. sulph. cum sulph. 50%), 5s. 11d. For quantities under 112 lb., 1d. extra; under 28 lb., 5d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NITRIC ACID.—Spot, £25 to £30 per ton according to strength, quantity and destination.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £55 per ton ex store.

PARAFFIN WAX.—SCOTLAND: 3½d. per lb.

POTASH CAUSTIC.—Solid, £35 5s. to £40 per ton according to quantity, ex store; broken, £42 per ton. MANCHESTER: £38.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4½d. per lb. MANCHESTER: £37 per ton.

POTASSIUM DICHROMATE.—5½d. per lb. carriage paid. SCOTLAND: 5½d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 6s. 3d. per lb. in 7 lb. lots.

POTASSIUM NITRATE.—Small granular crystals, £24 to £27 per ton ex store, according to quantity. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9½d. per lb. SCOTLAND: B.P. Crystals, 9½d. MANCHESTER: B.P. 10½d. to 11½d.

POTASSIUM PRUSSIAN.—6½d. per lb. SCOTLAND: 6½d. net, in casks, ex store. MANCHESTER: Yellow, 6½d. to 6½d.

PRUSSIAN OF POTASH CRYSTALS.—In casks, 6½d. per lb. net, ex store.

SALAMMONIAC.—Firsts lump, spot, £42 17s. 6d. per ton, d/d address in barrels. Dog-tooth crystals, £36 per ton; fine white crystals, £18 per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37 10s.

SALT CAKE.—Unground, spot, £3 11s. per ton.
SODA ASH.—58% spot, £5 17s. 6d. per ton f.o.r. in bags.
SODA, CAUSTIC.—Solid, 76/77° spot, 13s. 10s. per ton d/d station. **SCOTLAND:** Powdered 98/99%, £18 10s. in drums, £19 5s. in casks, Solid 76/77° £15 12s. 6d. in drums; 70/73%, £15 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts, 10s. per ton less.
SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
SODIUM ACETATE.—£19-£20 per ton carriage paid North. **GLASGOW:** £18 10s. per ton net ex store.
SODIUM BICARBONATE.—Refined spot, £10 15s. per ton d/d station in bags. **GLASGOW:** £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags. **MANCHESTER:** £10 15s.
SODIUM BISULPHITE POWDER.—60/62%, £14 10s. per ton d/d in 2-ton lots for home trade.
SODIUM CARBONATE MONOHYDRATE.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.
SODIUM CHLORATE.—£27 10s. to £32 per ton. **GLASGOW:** £1 11s. per cwt., minimum 3 cwt. lots.
SODIUM DICHROMATE.—Crystals cake and powder 4½d. per lb. net d/d U.K. with rebates for contracts.
SODIUM CHROMATE.—4½d. per lb. d/d U.K.
SODIUM HYPOSULPHITE.—Pea crystals, £15 5s. per ton for 2-ton lots; commercial, £11 5s. per ton. **MANCHESTER:** Commercial, £11; photographic, £15 10s.
SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d. **GLASGOW:** £1 12s. 0d. per cwt. in 1-cwt. kegs, net, ex store.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, 9½d. per lb. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—Di-sodium, £12 per ton delivered for ton lots. Tri-sodium, £15 to £16 per ton delivered per ton lots.
SODIUM PRUSSIAN.—½d. per lb. for ton lots. **GLASGOW:** 5d. to 5½d. ex store. **MANCHESTER:** 4½d. to 5½d.
SODIUM SILICATE.—£8 2s. 6d. per ton.
SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. **SCOTLAND:** Ground quality, £3 5s. per ton d/d. **MANCHESTER:** £3 12s. 6d.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 15s. per ton d/d in drums; crystals, 30/32%, £9 per ton d/d in casks. **MANCHESTER:** Concentrated solid, 60/62%, £11; commercial, £8 10s.
SODIUM SULPHITE.—Pea crystals, spot, £14 10s. per ton d/d station in kegs.
SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.
TARTARIC ACID.—1s. 1½d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. **MANCHESTER:** 1s. 1½d. per lb. **GLASGOW:** 1s. 1d. per lb., 5%, ex store.
ZINC SULPHATE.—Tech., £11 10s. f.o.r., in 2 cwt. bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 7d. to 1s. 2d. per lb., according to quality. Crimson, 1s. 6d. to 1s. 7½d. per lb.
ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £6 10s. per ton, according to quality.
CADMIUM SULPHIDE.—3s. 11d. to 4s. 2d. per lb.
CARBON BLACK.—3½d. to 3 15/16d. per lb., ex store.
CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.
CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 10½d. to 11d. per lb.
DIPHENYLGUANIDINE.—2s. 2d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 4½d. to 5½d. per lb.; dark 3½d. to 4½d. per lb.
LAMP BLACK.—£24 to £26 per ton del., according to quantity. Vegetable black, £35 per ton upwards.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE.—Spot, 30%, £16 10s. per ton, 2-ton lots d/d in bags.
SULPHUR.—£9 to £9 5s. per ton. **SULPHUR PRECIP. B.P.,** £55 to £60 per ton. **SULPHUR PRECIP. COMM.,** £50 to £55 per ton.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.
VERMILION.—Pale, or deep, 4s. 9d. per lb., 1-cwt. lots.
ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1938: November, £7 8s.; December, £7 9s. 6d.; January, 1938, £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.
CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1938: November, £7 10s.; December, £7 11s. 3d.; January, 1938, £7 12s. 6d.; February, £7 13s. 9d.; March, £7 15s.; April/June, £7 16s. 3d.
NITRO CHALK.—£7 10s. 6d. per ton up to June 30, 1938.

SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1938.
CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

Coal Tar Products

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor, 1s. 3d. to 1s. 3½d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 8d. to 1s. 8½d. **GLASGOW:** Crude, 10d. to 10½d. per gal.; motor, 1s. 4d. to 1s. 4½d. **MANCHESTER:** Pure, 1s. 8d. per gal.; crude, 11d. to 1s. per gal.
CARBOLIC ACID.—Crystals, 7½d. to 8½d. per lb., small quantities would be dearer; Crude, 60's, 1s. 10½d. to 2s. 1½d.; dehydrated, 3s. to 3s. 3d. per gal. **MANCHESTER:** Crystals, 7d. to 7½d. per lb. f.o.b. in drums; crude, 2s. 3d. per gal.
CREOSOTE.—Home trade, 4½d. per gal., f.o.r. makers' works; exports 6½d. to 6¾d. per gal., according to grade. **MANCHESTER:** 4½d. to 5½d. **GLASGOW:** B.S.I. Specification, 6d. to 6½d. per gal.; washed oil, 5d. to 5½d.; lower sp. gr. oils 5½d. to 6½d.
CRESYLIC ACID.—97.99%, 1s. 9d. to 2s.; 99/100%, 2s. 6d. to 3s. per gal., according to specification; Pale, 99/100%, 2s. 1d. to 2s. 3d.; Dark, 95%, 1s. 7d. to 1s. 8d. per gal. **GLASGOW:** Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale, 97/99%, 4s. 6d. to 4s. 10d.; dark, 97/99%, 4s. 3d. to 4s. 6d.; high boiling acids, 2s. to 2s. 6d. American specification, 3s. 9d. to 4s. **MANCHESTER:** Pale, 99/100%, 2s. 4d.
NAPHTHA.—Solvent, 90/160, 1s. 6d. to 1s. 7d. per gal.; solvent, 95/160%, 1s. 7d. to 1s. 8d., naked at works; heavy 90/190%, 1s. 1d. to 1s. 3d. per gal., naked at works, according to quantity. **GLASGOW:** Crude, 6½d. to 7½d. per gal.; 90%, 160, 1s. 5d. to 1s. 6d.; 90%, 190, 1s. 1d. to 1s. 3d.
NAPHTHALENE.—Crude, whizzed or hot pressed, £5 to £6 per ton; purified crystals, £11 10s. per ton in 2-cwt. bags. **LONDON:** Fire lighter quality, £3 to £4 10s. per ton. **GLASGOW:** Fire lighter, crude, £6 to £7 per ton (bags free) **MANCHESTER:** Refined, £14 to £15, per ton f.o.b.
PITCH.—Medium, soft, 33s. per ton, f.o.b. **MANCHESTER:** 31s. 6d. f.o.b., East Coast. **GLASGOW:** f.o.b. **GLASGOW:** 35s. to 37s. per ton; in bulk for home trade, 35s.
PYRIDINE.—90/140%, 12s. to 14s. per gal.; 90/160%, 10s. to 11s. 3d. per gal.; 90/180%, 3s. to 4s. per gal. f.o.b. **GLASGOW:** 90% 140, 10s. to 12s. per gal.; 90% 160, 9s. to 10s.; 90% 180, 2s. 6d. to 3s. **MANCHESTER:** 9s. to 10s. per gal.
TOLUOL.—90%, 1s. 10d. per gal.; pure, 2s. 2d. **GLASGOW:** 90%, 120, 1s. 10d. to 2s. 1d. per gal.
XYLOL.—Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 3d. to 2s. 3½d. **GLASGOW:** Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £7 5s. to £9 15s. per ton; grey, £9 5s. to £9 15s. **MANCHESTER:** Brown, £8 10s.; grey, £10.
METHYL ACETONE.—40.50%, £35 to £40 per ton.
WOOD CREOSOTE.—Unrefined, 4d. to 6d. per gal., according to boiling range.
WOOD NAPHTHA, MISCIBLE.—3s. 3d. to 3s. 6d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.
WOOD TAR.—£2 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 7½d. per lb., 100% as base, in casks.
BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 11½d. per lb. d/d buyer's works.
m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-CRESOL, 34.5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.
DICHLORANILINE.—2s. 1½d. to 2s. 5½d. per lb.
DIMETHYLANILINE.—Spot, 1s. 7½d. per lb., package extra.
DINITROBENZENE.—8d. per lb.
DINITROCHLOROBENZENE, SOLID.—£79 5s. per ton.
DINITROTOLUENE.—48/50° C., 9½d. per lb.; 66/68° C., 11d.
DIPHENYLAMINE.—Spot, 2s. 2d. per lb., d/d buyer's works.
GAMMA ACID, Spot, 4s. 4½d. per lb. 100% d/d buyer's works.
H ACID.—Spot, 2s. 7d. per lb.; 100% d/d buyer's works.
NAPHTHIONIC ACID.—1s. 10d. per lb.
β-NAPHTHOL.—£97 per ton; flake, £94 8s. per ton.
α-NAPHTHYLAMINE.—Lumps, 1s. 1d. per lb.
β-NAPHTHYLAMINE.—Spot, 3s. per lb.; d/d buyer's works.
NEVILLE AND WINTHER'S ACID.—Spot, 3s. 3½d. per lb. 100%.
o-NITRANILINE.—4s. 3½d. per lb.
m-NITRANILINE.—Spot, 2s. 10d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 10d. to 2s. 3½d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 4¾d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—10½d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 11d. per lb.; 100% d/d buyer's works.
SULPHANILIC ACID.—Spot, 8½d. per lb. 100%, d/d buyer's works
o-TOLUIDINE.—11d. per lb., in 8/10 cwt. drums, drums extra.
p-TOLUIDINE.—1s. 11d. per lb., in casks.
m-XYLYDINE ACETATE.—4s. 8d. per lb., 100%.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Application for Patents

COLOURING-MATTERS.—Manchester Oxide Co., Ltd., J. H. Clayton, and B. Bann. 20995.

MANUFACTURE OF BRANCHED, ETC., ALKENES from non-branched, etc., alkenes.—Naamloze Vennootschap de Bataafsche Petroleum Maatschappij. (Holland, Aug. 14, '37.) 21148.

CONTINUOUS PRODUCTION OF GLASS having a plurality of layers. Neue Glasindustrie-Ges. (Germany, July 19, '37.) 21142.

PROCESS FOR THE DRY-DISTILLATION, ETC., OF FINE DUST COAL of less caking nature.—H. Osawa. (Japan, July 19, '37.) 21458.

METHOD OF PRODUCING GRANULAR, ETC., BIOLOGICAL COMPOSITE FERTILISERS.—K. Petersen. (Denmark, June 20.) 21319.

RESISTANCE OF METALS TO CORROSION.—Pyrene Co., Ltd. (United States, July 20, '37.) 21201.

DETERGENTS.—E. Rech. 21158.

MANUFACTURE OF VARNISH PAINT resistant to petrol, etc.—Rubtex, Ltd., and P. Slansky. 21387.

DISTILLATION, ETC., OF SOLID CARBONACEOUS, ETC., MATERIALS.—E. M. Salerni. 20890.

PRODUCTION OF XANTHOGENATE SOLUTIONS from unbleached cellulose produced by alkaline decomposition.—Schlesische Zellwalle, A.-G. (Germany, July 29, '37.) 21184.

DISTILLATION, ETC., OF SOLID CARBONACEOUS MATERIALS.—Simon-Carves, Ltd., J. H. Leigh, British Coal Distillation, Ltd., and C. Machen. 20891.

PRODUCTION OF INORGANIC, ETC., COMPOUNDS.—E. Slatineanu. 20963.

MANUFACTURE OF ALLOYS OF SILICON.—Soc. d'Electrochimie, d'Electro-Metallurgie, et des Acieries Electriques d'Ugine, and J. L. Andrieux. (France, July 28, '37.) 20934; (France, June 8.) 20935.

METHOD, ETC., OF ANALYSING GASEOUS MIXTURES.—Soc. Française des Regulateurs Universels Arca, and R. J. Siretta. (France, July 23, '37.) 21092.

MANUFACTURE OF KETONES of the cyclopentano-polyhydrophenanthrene series.—Soc. of Chemical Industry in Basle. (Switzerland, July 14, '37.) 20901; (Switzerland, June 9.) 20902; (Switzerland, June 14.) 20903; (Switzerland, June 24.) 20904.

MANUFACTURE OF OXYTHIOETHERS.—Soc. of Chemical Industry in Basle. (Switzerland, July 14, '37.) 20905; (Switzerland, June 18.) 20906.

MANUFACTURE OF POLYOXY COMPOUNDS of the cyclopentano polyhydrophenanthrene series, etc.—Soc. of Chemical Industry in Basle. (Switzerland, July 17, '37.) 21249; (Switzerland, June 15.) 21250.

MANUFACTURE OF DERIVATIVES of the saturated cyclopentano polyhydrophenanthrene series.—Soc. of Chemical Industry in Basle. (Switzerland, July 19, '37.) 21252; (Switzerland, June 22.) 21253.

MANUFACTURE OF ESTERS OF DIPHENYLENEACETIC ACID.—Soc. of Chemical Industry in Basle. (Switzerland, July 21, '37.) 21254.

MANUFACTURE OF CYCLIC KETONES of the saturated, etc., cyclopentano polyhydrophenanthrene series.—Soc. of Chemical Industry in Basle. (Switzerland, July 22, '37.) 21404; (Switzerland, March 15.) 21405; (Switzerland, April 6.) 21406; (Switzerland, May 12.) 21407.

MANUFACTURE OF MELAMINE.—Soc. of Chemical Industry in Basle. (Switzerland, July 24, '37.) 21544.

PROCESS FOR THE INTRAMOLECULAR DEHYDROGENATION OF AROMATIC NUCLEI.—Soc. of Chemical Industry in Basle. (Switzerland, July 23, '37.) 21545.

MINIMISING, ETC., FERROUS ABRASIVES.—H. E. Stride. 21478.

TREATMENT OF GELATINE, ETC.—Tannerie et Maroquinerie Belges Soc. Anon. (Belgium, Aug. 12, '37.) 21508.

REDUCTION OF METALLIC OXIDES.—Thermoloy, Ltd., and P. Adeline. 21081, 21082, 21083.

TEXTILE FINISHING PROCESSES.—Tootal Broadhurst Lee Co., Ltd., H. Corteen, and F. C. Wood. (Aug. 27, '37.) 20861.

MANUFACTURE OF CATALYSTS.—W. P. Williams (Procter and Gamble Co.). (Jan. 28.) 21117.

PROCESS FOR PRODUCING MAGNESIUM OXIDE FROM DOLOMITE.—Wspólneta Akcyjna, and W. Dominik. 21318.

PRODUCTION OF UREA-FORMALDEHYDE CONDENSATION PRODUCTS.—Albert Products, Ltd. (Germany, Aug. 12, '37.) 21823.

PREPARATION OF LUMINOUS ENAMELS.—Auerger, A.-G. (Germany, July 30, '37.) 21847.

COATING OF ARTICLES WITH RESINOUS MEDIA.—E. Bader. 21995.

HALOGENATED ESTERS.—D. J. Branscombe and Imperial Chemical Industries, Ltd. 22090.

MANUFACTURE OF PROGESTERONE.—Chinoïn Gyógyszer Es Vegyeszeti Termékek Gyára Reszvenytársaság, Dr. Kereszty and Dr. Wolf, and H. Bretschneider. 21705.

PRODUCTION OF ACYLACETYL DERIVATIVES, ETC.—Compagnie Nationale de Matières Colorantes et Manufactures de Produits Chimiques du Nord Reunies Etablissements Kuhlmann. (France, July 27, '37.) 22289; (France, June 30.) 22290.

OLEFINE OXIDATION AND CATALYST THEREFOR.—Carbide and Carbon Chemicals Corporation. (United States, Aug. 7, '37.) 21872, 21873, 21874.

STERILISING, ETC., MEANS FOR DRINKING-WATER.—C. A. C. Carrington. (Sweden, Aug. 18, '37.) 21930; (Sweden, June 25.) 21931.

METHOD, ETC., FOR DYEING, ETC. TEXTILES.—W. B. Brown. 22303.

TREATMENT OF RUBBER DISTILLATES.—R. B. Croad, F. N. Pickett, and Consolidated Rubber Manufacturers, Ltd. 22308.

PROCESS FOR BLEACHING ARTIFICIAL TEXTILE FIBRES, ETC.—Deutsche Gold-und Silber-Scheidanstalt vorm. Roessler. (Germany, Aug. 6, '37.) 22222.

DYEING ASSISTANT FOR DYEING ACETATE SILK, ETC.—A. Dogliani. 22257.

METHODS OF PREPARING CONCENTRATES OF NATURAL VITAMINS.—J. C. Drummond. 22255.

MANUFACTURE OF PENTAVALENT NITROGEN COMPOUNDS.—E. I. du Pont de Nemours and Co. (United States, July 21, '37.) 21729.

CELLULOSIC TEXTILES, ETC.—E. I. du Pont de Nemours and Co. and W. W. Heckert. 21730.

STARCH DERIVATIVES of high viscosity.—E. I. du Pont de Nemours and Co., and R. W. Maxwell. 22092.

MANUFACTURE OF STABLE DIAZO-SALTS.—E. I. du Pont de Nemours and Co., W. A. Erickson, and F. W. Wanderer. 21856.

LEAD ALLOYS.—H. G. C. Fairweather (Compagnie Generale d'Electricite). 22381.

MEANS, ETC., FOR THE CONDUCT OF REACTIONS IN DILUTE SOLUTIONS.—E. Fischer. (Germany, July 23, '37.) 22111.

PROCESS, ETC., FOR THE DEODORISATION OF ANIMAL AND VEGETABLE OILS.—Foster Wheeler, Ltd. (United States, July 22, '37.) 21803.

MANUFACTURE OF WATER GAS.—Gas Light and Coke Co., and S. Pexton. 21923.

MANUFACTURE OF PROPYLENE OXIDE SULPHONIC ACIDS.—W. W. Groves (I. G. Farbenindustrie.) 22019.

Specifications Open to Public Inspection

CATALYTIC METHOD OF AND APPARATUS FOR CRACKING HYDROCARBONS.—Standard Oil Development Co. Jan. 21, 1937. 31956/37.

MANUFACTURE OF SENSITISING DYES of the cyanine series.—I. G. Farbenindustrie. Jan. 25, 1937. 33058/37.

BENZENESULPHONAMIDOLAMIDE DERIVATIVES and process of producing them.—E. Lilly and Co. Jan. 23, 1937. 33373/37.

BENZENESULPHONHYDROXAMIDE DERIVATIVES and process of producing them.—E. Lilly and Co. Jan. 23, 1937. 33375/37.

MANUFACTURE OF LUBRICATING OILS.—Standard Oil Development Co. Jan. 19, 1937. 35502/37.

METHODS FOR MAKING CAST IRON.—Electro Metallurgical Co. Jan. 25, 1937. 35951/37.

PROCESSES OF MAKING PIGMENTS.—Interchemical Corporation. Jan. 21, 1937. 532/38.

p-CARBAMIDOBENZENE-SULPHONAMIDE and process of producing it.—E. Lilly and Co. Jan. 23, 1937. 728/38.

MANUFACTURE OF STEEL.—F. P. Mehta. Jan. 21, 1937. 855-6/38.

PROCESS AND CONTRIVANCE FOR THE DIRECT MANUFACTURING OF STEEL and other metals starting from the ore.—A. Auriol, and A. Auriol. Jan. 19, 1937. 1178/38.

MANUFACTURE AND PRODUCTION OF CARBOXYLIC ACID NITRILES.—I. G. Farbenindustrie. Jan. 20, 1937. 1491/38.

MANUFACTURE OF STABLE PREPARATIONS CONTAINING ERGOMETRINE.—Naamloze Vennootschap Orgachemia. Jan. 19, 1937. 1825/38.

COLOURING PROCESSES.—Opticolor, A.-G. Jan. 20, 1937. 1907/38.

APPARATUS FOR THE OLIGODYNAMIC ACTIVATION OF WATER.—J. Deninger. Jan. 20, 1937. 1946/38.

PRODUCTION OF INTERMEDIATES in the manufacture of hormones. Naamloze Vennootschap Organon. Jan. 20, 1937. 1957/38.

PRODUCTION OF AMINONITRILES.—Bergwerksverband Zur Verwertung Von Schutzrechten Der Kohlentechnik Ges. Jan. 20, 1937. 1981/38.

METHOD OF PRODUCING MALLEABLE IRON.—A. G. E. Hultgren. Jan. 25, 1937. 2099/38.

RUBBER COMPOUNDS or products and method of making the same.—J. Stein. Jan. 21, 1937. 2101/38.

AZO DYESTUFFS and their manufacture.—E. I. du Pont de Nemours and Co. Jan. 23, 1937. 2300/38.

AZO COMPOUNDS and dyestuffs derived therefrom.—E. I. du Pont de Nemours and Co. Jan. 23, 1937. 2301/38.

MANUFACTURE OF MAGNESIUM-OXIDE from dolomite.—P. Perani. Jan. 23, 1937. 2304/38.

COLOURING RUBBER HYDROCHLORIDE SOLUTIONS.—Wingfoot Corporation. Jan. 26, 1937. 24474/37.

PROCESS FOR THE MANUFACTURE OF ALCOHOLS OF STEROIDS doubly unsaturated in ring A.—Schering, A.-G. Feb. 1, 1937. 26399/37.

- ELECTRODEPOSITION OF NICKEL ON METALS.—Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. Feb. 1, 1937. 24806/37.
- METHOD OF MAKING RUBBER HYDROHALIDES and product thereof.—Wingfoot Corporation. Jan. 26, 1937. 27946/37.
- RUBBER HYDROHALIDES.—Wingfoot Corporation. Jan. 28, 1937. 27947/37.
- RHEOSTATS AND POTENTIOMETERS.—International Resistance Co. Jan. 7, 1937. 30786/37.
- ZINC ALLOYS.—National Smelting Co., Ltd. Feb. 1, 1937. 32213/37.
- MANUFACTURE OF DIMERS OF OLEFINS.—Standard Oil Development Co. Jan. 29, 1937. 34651/37.
- PRODUCING STABLE COPPER-HYDROXIDE.—New Process Rayon, Inc. Jan. 26, 1937. 35484/37.
- MANUFACTURE OF FUEL OILS.—Standard Oil Development Co. Jan. 30, 1937. 128/38.
- RECOVERY OF AROMATIC HYDROCARBONS from mixtures of aliphatic, hydroaromatic, and aromatic hydrocarbons.—J. Haltermann. Jan. 30, 1937. 144/38.
- OBTAINING SALTS OF SULPHANILAMIDE with non-volatile acids.—M. Woelm. Jan. 26, 1937. 1610/38.
- PROCESS FOR MANUFACTURING GLUCOSE and glucose syrup.—Naamlooze Vennootschap Oetooien Maatschappij Activit. Jan. 27, 1937. 1830/38.
- PRODUCTION OF PURE ALUMINA.—Dyckerhoff Portland Zementwerke, A.G. Jan. 29, 1937. 1931/38.
- PHYSIOLOGICALLY-ACTIVE ALKALOID and process for its manufacture.—Chemical Works, formerly Sandoz. Jan. 27, 1937. 2426/38.
- MANUFACTURE AND PRODUCTION OF SUBSTANCES having tanning action.—I. G. Farbenindustrie. Jan. 27, 1937. 2077/38.
- HIGH MELTING-POINT SILICATE REFRACTORIES.—E. J. Lavino and Co. Jan. 28, 1937. 2244/38.
- MANUFACTURE OF AZO-DYESTUFF DERIVATIVES.—Soc. of Chemical Industry in Basle. Jan. 26, 1937. (Cognate Application, 2515/38.) 2514/38.
- METHOD OF SYNTHESISING LIQUID HYDROCARBONS.—M. W. Kellogg Co. Jan. 26, 1937. 2516/38.
- PURIFYING HYDROCARBON COMPOUNDS in the gaseous stage.—Soc. Industrielle Des Carburants et Solvants. Feb. 1, 1937. 2612/38.
- SPONGY RUBBER MASS adapted to swell under the action of liquid hydrocarbons, and processes for the manufacture and employment of such mass.—E. Solcia. Jan. 30, 1937. 2678/38.
- SEPARATING ETHER OUT OF MIXTURES OF ETHER and aqueous alcohol.—Buss, A.G. Jan. 29, 1937. 2824/38.
- PROCESS OF MANUFACTURING SIMULTANEOUSLY PURE ALUMINIUM-OXIDE and magnesium-ammonium phosphate.—C. D. Asseev. Feb. 1, 1937. 3114/38.
- Specifications Accepted with Dates of Application**
- CONDENSATION OF ORGANIC METAL DERIVATIVES with acylated compounds.—Naamlooze Vennootschap Chemische Fabriek Servo, and M. D. Rozenbroek. Oct. 14, 1936. (Samples furnished.) 489,026.
- POLYMERISATION OF OLEFINS.—Standard Oil Development Co. Dec. 31, 1935. 489,219.
- ANODIC TREATMENT OF ALUMINIUM and aluminium alloys.—C. H. R. Gower, and E. Windsor-Bowen. Nov. 17, 1936. 489,220.
- PROCESS FOR THE MANUFACTURE OF AZO DYESTUFFS.—A. Carpmal (I. G. Farbenindustrie.) Dec. 16, 1936. (Samples furnished.) 489,035.
- FUNGICIDAL COMPOSITIONS.—J. Chapman, and Imperial Chemical Industries, Ltd. Dec. 16, 1936. 489,222.
- SEPARATING GASEOUS MIXTURES by liquefaction and rectification. L. Mellersh-Jackson (Soc. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude). Dec. 17, 1936. 489,036.
- WETTING AND CLEANSING AGENTS.—W. P. Williams (Procter and Gamble Co.). Dec. 17, 1936. 489,097.
- PRODUCTION OF FATTY ACIDS.—C. Weizmann. Jan. 18, 1937. 489,170.
- MANUFACTURE OF GASOLINE-LIKE HYDROCARBONS by the polymerisation of hydrocarbon gases.—A. H. Stevens (Process Management Co., Inc.). Jan. 19, 1937. 489,105.
- MANUFACTURE OF CELLULOSE ESTERS of lower aliphatic acids.—A. J. Watters, and Imperial Chemical Industries, Ltd. Jan. 19, 1937. 489,110.
- MANUFACTURE OF AMINO COMPOUNDS of the anthraquinone series. British Celanese, Ltd., G. Lord, and G. Reeves. Jan. 20, 1937. (Addition to 460,440.) 489,172.
- MANUFACTURE OF AMINE RESINS: application thereof as base exchange bodies or the like.—W. W. Groves (I. G. Farbenindustrie.) Jan. 20, 1937. (Sample furnished.) 489,173.
- MANUFACTURE OF CONDENSATION PRODUCTS.—W. W. Groves (I. G. Farbenindustrie.) Jan. 21, 1937. 489,330.
- GASEOUS CEMENTATION OF STEEL.—L. Renault. Dec. 15, 1936. (Addition to 480,103.) 489,177.
- RESIST EFFECTS ILLUMINATED WITH VAT DYESTUFFS.—D. P. Milburn, and Imperial Chemical Industries, Ltd. Jan. 21, 1937. 489,235.
- CARRYING OUT CHEMICAL REACTIONS with reactive or atomic hydrogen.—D. Gardner. Jan. 21, 1937. 489,280.
- MANUFACTURE AND PRODUCTION OF NAPHTHALENE DERIVATIVES.—G. W. Johnson (I. G. Farbenindustrie.) Jan. 22, 1937. 489,236.
- MANUFACTURE AND USE OF DYESTUFFS suitable for sensitising photographic emulsions.—D. J. Fry, and J. D. Kendall. Jan. 22, 1937. (Samples furnished.) 489,335.
- ELECTRODEPOSITION OF CADMIUM.—E. I. du Pont de Nemours and Co., and J. A. Henricks, jun. Jan. 22, 1937. 489,339.
- PROCESSES AND APPARATUS FOR THE EXTRACTION OF CELLULOSIC FIBRES from vegetable material.—U. Pomillo. Jan. 23, 1937. 489,302.
- ARTICLES OF RUBBER or the like and methods of manufacturing the same.—R. Stahl. Jan. 25, 1936. 489,305.
- CATALYSTS.—W. W. Groves (I. G. Farbenindustrie.) Jan. 25, 1937. 489,306.
- MANUFACTURE OF SUBSTITUTED CARBOXYLIC ACID AMIDES and their polymerisation products.—E. I. du Pont de Nemours and Co. Jan. 24, 1936. 489,311.
- MANUFACTURE AND PRODUCTION OF SILICON FLUORINE COMPOUNDS. G. W. Johnson (I. G. Farbenindustrie.) Jan. 25, 1937. 489,043.
- MANUFACTURE OF NITROGEN COMPOUNDS.—W. J. Tennant (Henkel and Cie, Ges.). March 1, 1937. 489,190.
- MANUFACTURE OF VULCANISED RUBBER.—J. R. Geigy, A.-G. Aug. 1, 1936. 489,205.
- MAGNESIUM ALLOYS.—G. Von Giese's Erben. April 15, 1937. 489,320.
- CONVERTING GOLD, PLATINUM, and other metals of the platinum group, into a dissolved form.—Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. Jan. 20, 1937. 489,149.
- METHOD OF BRIGHT-PICKLING ARTICLES of copper-zinc alloys.—G. Von Giese's Erben. Sept. 30, 1936. 489,211.
- CONCENTRATION OF ALIPHATIC ACIDS.—British Celanese, Ltd. Nov. 14, 1936. 489,259.
- ACTIVATION OF CHOLESTEROL.—E. Lilly and Co. Jan. 18, 1937. 489,083.
- MANUFACTURE OF CONDENSATION PRODUCTS.—W. W. Groves (I. G. Farbenindustrie.) Jan. 21, 1937. 489,343.
- PRESERVATION OF RUBBER.—Monsanto Chemical Co. Feb. 25, 1937. 489,157.
- APPARATUS FOR USE IN ACTIVATING AND REACTIVATING CHARCOAL, carbon, and like substances, and for use in revivifying Kieselguhr and the like.—Blairs, Ltd., and N. E. Lamont. Oct. 23, 1936. 489,360.
- MANUFACTURE OF WATER-SOLUBLE COMPOUNDS of the androstane and pregnane series.—A. G. Bloxam (Soc. of Chemical Industry in Basle.) Nov. 25, 1936. 489,364.
- PETROLEUM AND COAL-TAR EMULSIONS.—H. E. G. West, and A. H. Dodd. Dec. 22, 1936. 489,372.
- PRODUCING FAST DYEINGS.—G. W. Johnson (I. G. Farbenindustrie.) Jan. 24, 1937. 489,429.
- WATERPROOFING TEXTILE MATERIALS.—W. W. Groves (I. G. Farbenindustrie.) Jan. 23, 1937. (Samples furnished.) 489,495.
- MANUFACTURE OF MONOARYLIDES or mono-hydroarylides of aromatic dicarboxylic acid halides.—W. W. Groves (I. G. Farbenindustrie.) Jan. 25, 1937. 489,430.
- ART OF REFINING HYDROCARBONS.—Oil Processes, Ltd. Jan. 23, 1936. 489,544.
- METHOD OF PREPARING COLLOIDAL DISPERSIONS of solids in liquids.—K. Sollner, and E. G. Acheson, Ltd. Jan. 25, 1937. 489,610.
- APPLICATION OF BASE EXCHANGE ARTIFICIAL RESINS for purifying aqueous solutions.—I. G. Farbenindustrie. Feb. 1, 1936. 489,437.
- MANUFACTURE OF FILMS and foils from polymerisation products. W. W. Groves (I. G. Farbenindustrie.) Jan. 26, 1937. 489,550.
- PROCESS FOR THE MANUFACTURE OF LACQUER RAW MATERIALS from fossil resins.—A. Carpmal (I. G. Farbenindustrie.) Jan. 26, 1937. 489,439.
- PRODUCTION OF VALUABLE OXIDATION PRODUCTS from aliphatic hydrocarbons.—Henkel and Cie, Ges. March 31, 1936. 489,443.
- MANUFACTURE OF FLUORENE DERIVATIVES.—G. Sheldrick, M. Wyler, and Imperial Chemical Industries, Ltd. Jan. 27, 1937. 489,612.
- DYEING PROCESS FOR CELLULOSE ESTERS or ethers.—H. Blackshaw, H. A. Thomas, and Imperial Chemical Industries, Ltd. Jan. 27, 1937. 489,613.
- MANUFACTURE OF ADHESIVES composed of water-soluble cellulose ethers.—W. J. Tennant (Henkel and Cie, Ges.). Jan. 27, 1937. 489,614.
- CATALYST OF HIGH MECHANICAL STRENGTH.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). Jan. 28, 1937. 489,551.
- MANUFACTURE OF HIGHER HALOGENATED KETONES.—I. G. Farbenindustrie. Jan. 28, 1936. (Samples furnished.) 489,552.
- METHOD OF CHLORINATING METHANE or a homologue thereof.—I. G. Farbenindustrie. Jan. 28, 1936. 489,553.
- MANUFACTURE OF HIGHER CHLORINATED METHANES.—I. G. Farbenindustrie. Jan. 29, 1936. 489,554.
- PREPARATION OF MAGNESIUM.—G. N. Kirsebom, and Calloy, Ltd. Jan. 28, 1937. 489,629.
- PRODUCTION OF MODIFIED DEXTRINS.—Distillers Co., Ltd., and P. D. Coppock. Jan. 28, 1937. 489,379.
- MANUFACTURE OF DIAZO-DYESTUFFS.—I. G. Farbenindustrie. March 31, 1936. 489,562.

METHOD OF COUNTERACTING THE POLYMERISATION of vinyl-methyl ketone during distillation or storage.—W. W. Groves (I. G. Farbenindustrie.) Jan. 29, 1937. 489,634.

MANUFACTURE OF BORON CARBIDES.—I. G. Farbenindustrie. Jan. 30, 1936. 489,563.

MANUFACTURE OF FERTILISERS.—L. G. Tom, and Three Towns Storage, Ltd. Jan. 29, 1937. 489,567.

PRODUCTION OF NUTRITIVE AND THERAPEUTIC PRODUCTS from whey.—Kraft-Phenix Cheese Corporation. Jan. 29, 1936. 489,637.

COLOURATION OF ALUMINIUM POWDER.—F. Hill, J. A. Radley, and Imperial Chemical Industries, Ltd. Jan. 29, 1937. 489,574.

DYEING OF HARDENED CASEIN.—F. Hill, J. A. Radley, and Imperial Chemical Industries, Ltd. Jan. 29, 1937. 489,575.

PRODUCTION OF GLYCOLS.—C. Barbieri. Jan. 29, 1937. 489,576.

PURIFICATION OF COMBUSTIBLE GASES.—Gas Light and Coke Co., R. H. Griffith, and J. H. G. Plant. March 19, 1937. 489,398.

METHOD OF AND APPARATUS FOR THE CONTINUOUS SUBSEQUENT TREATMENT AND DRYING OF CELLULOSE WOOL IN WEB FORM.—Schlesische Zellwolle, A.-G. April 20, 1936. 489,401.

LOW-TEMPERATURE EXTRACTION OF LIGHT HYDROCARBON MIXTURES.—Edeleanu Ges. July 8, 1936. 489,455.

REFINING OF HYDROCARBON OILS.—Edeleanu Ges. June 23, 1936. 489,456.

AZO DYE STUFFS.—Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies Etablissements Kuhlmann. Aug. 4, 1936. 489,458.

CHILL MOULD for the production of ingots and like workpieces, of compact texture, from metals or alloys, especially alloys of aluminium or magnesium.—Durener Metallwerke, A.-G. July 3, 1937. 489,605.

Company News

International Nickel Company of Canada, Ltd., in their interim financial statement for the six months ended June 30, 1938, show a net profit of \$6,618,486, equivalent to 42 cents per share on the common stock after allowing for preferred dividend, for the second quarter of 1938. This compares with a net profit of \$10,113,764 for the first quarter of the current year, which was equal to 66 cents per share on the common stock.

BURNARD AND ALGER, LTD., Plymouth, chemical manufacturers. (M.S., 13/8/38.) Satisfaction July 26, of mortgage registered January 10, 1922.

County Court Judgment

COLLINS, Ernest Geo., Riversdale Court, 17 Wilbury Road, Hove, soap manufacturer. (C.C., 13/8/38.) £19 6s. 10d. March 24. (Exor. of Edith Emma Morris, deceased).

Declaration of Solvency Filed

BRITISH HYDROGENATION, LTD., London, S.W. (D.S.F., 13/8/38.) July 28.

Receiverships

BRITTON SYNDICATE, LTD., Brentford, oil manufacturers. T. J. Swinney, 40 Sheen Lane, S.W.14 (has been appointed receiver). July 30.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—A well-established firm of agents at Calcutta wishes to obtain the representation of United Kingdom exporters of patent medicines for India. (Ref. No. 93.)

Cuba.—The late manager in Cuba of an important United Kingdom concern, who is about to take up residence again in Cuba, wishes to obtain the local representation of United Kingdom exporters of oils and paints. (Ref. No. 109.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

STEWARTS AND LLOYDS, LTD. (incorporated in Scotland). (M., 13/8/38.) July 27, charge by way of collateral security to Trust Deed dated January 30, 1934; charged on properties at Corby, etc.

Satisfactions

ACME CHEMICAL CO., LTD., Tonbridge. (M.S., 13/8/38.) Satisfactions July 26, of mortgage registered December 1, 1924, and transfer of mortgage and further charge, registered January 2, 1928.

LEVER BROTHERS AND UNILEVER, LTD., Port Sunlight, soap manufacturers. (M.S., 13/8/38.) Satisfactions July 29, of debenture stock registered May 4, 1932, and November 1, 1932, to extent of £68,800 and £45,763 respectively.

Chemical and Allied Stocks and Shares

DESPITE the commencement of a new Stock Exchange account, the industrial and other sections of the stock and share markets have remained inactive. Nevertheless, share values were fairly well maintained, and securities of companies associated with the chemical and kindred industries had a steady appearance. Imperial Chemical ordinary units, market view in connection with which were mentioned last week, were reported to be more active, and on balance the price has moved up from 31s. 7½d. to 32s. at the time of writing. The general assumption is that the interim dividend is likely to be 3 per cent. or 2½ per cent. Distillers are 98s. 3d., compared with 98s. 6d. a week ago, and Murex at 80s. and Turner and Newall at 79s. 6d. have also been fairly steady.

British Match were firm at 33s. 3d. and Borax Consolidated at 26s. 6d. were also well maintained, as were United Premier Oil and Cake ordinary at 7s. 3d. and British Oil and Cake Mills preferred ordinary at 45s., while Swedish Match continued to transfer around 26s., General Refractories were affected by uncertainty whether the forthcoming interim dividend will be maintained, and have gone back from 13s. 6d. to 12s. 9d. On the other hand, some buying of United Glass Bottle ordinary was reported, and the price has improved to 50s. 6d. on the hope that the impending interim payment may be raised to 4 per cent. Last year the interim was 3½ per cent., followed by a final of 8½ per cent., making a total dividend of 12 per cent., and this represented a very conservative treatment of profits, as earnings on the shares were well in excess of this rate. On the other hand, it is the company's usual practice to leave all question of a larger payment until the final dividend. Triplex Glass 10s. ordinary units, which continued to fluctuate sharply, awaiting the dividend announcement, are 34s. 3d. at the time of writing. Market estimates of the dividend vary a good deal and range from 20 per cent. to 30 per cent. Lancagay Safety Glass were higher at 3s. 7½d. British Indestructo Glass

shares at 2s. 10½d. are virtually the same as a week ago.

Fison Packard and Prentice attracted rather more attention, and are quoted 6d. higher at 34s. 6d.; business has been recorded up to 35s. Although no change was made in the interim dividend, some market men are continuing to budget for a rather higher final dividend making 10 per cent., or 1 per cent. more than for the previous year. British Industrial Plastics 2s. shares continued to change hands fairly actively, but were again quoted at 2s. 9d., Imperial Smelting ordinary shares were lower at 11s., and Associated Cement have moved down from 81s. 10½d. to 79s. 4½d. British Plaster Board at 27s. 6d. are within 3d. of the price ruling a week ago. Pinchin Johnson at 32s. were fairly well maintained, as were International Paint at 70s. 6d., awaiting next month's interim dividend announcements. British Aluminium at 49s. were unchanged on balance, and have developed a steadier appearance than in recent weeks. United Molasses at 23s. were also fairly steady.

Boots Pure Drug are little changed at 42s. 3d., as are Sangers at 23s. 4½d. and Timothy Whites and Taylors at 25s. 3d. British Drug Houses ordinary shares were quoted at 22s. 6d. B. Laporte were again 87s. 6d. and Greiff-Chemicals Holdings 5s. units 6s. 3d., while Monsanto Chemicals preference were maintained at 22s. 6d.

Courtaulds have improved further from 29s. 3d. to 30s. 10½d. in response to indications of better conditions in the rayon trade in the United States. International Nickel continued to fluctuate around \$51 pending publication of the quarterly earnings figures. Dufay-Chromex at 5s. 3d. have lost part of their recent gain, but remained active on talk of further developments in connection with colour films for the cinema industry. Ilford ordinary shares held their recent improvement. Leading oil shares fluctuated moderately. "Shell" were inclined to react, but Anglo-Iranian and Burmah Oil came in for attention on any decline in price.

